Metals Review

THE NEWS DIGEST MAGAZINE

VOLUME XXI—No. 5 | Testing and Inspection Issue | MAY, 1948

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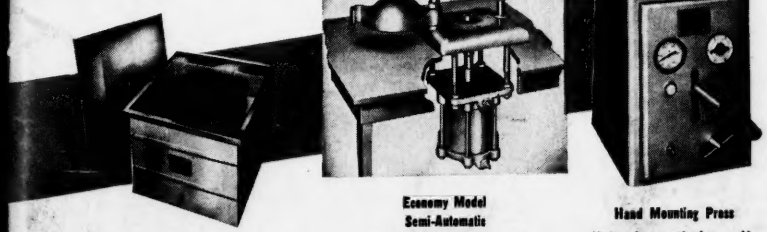

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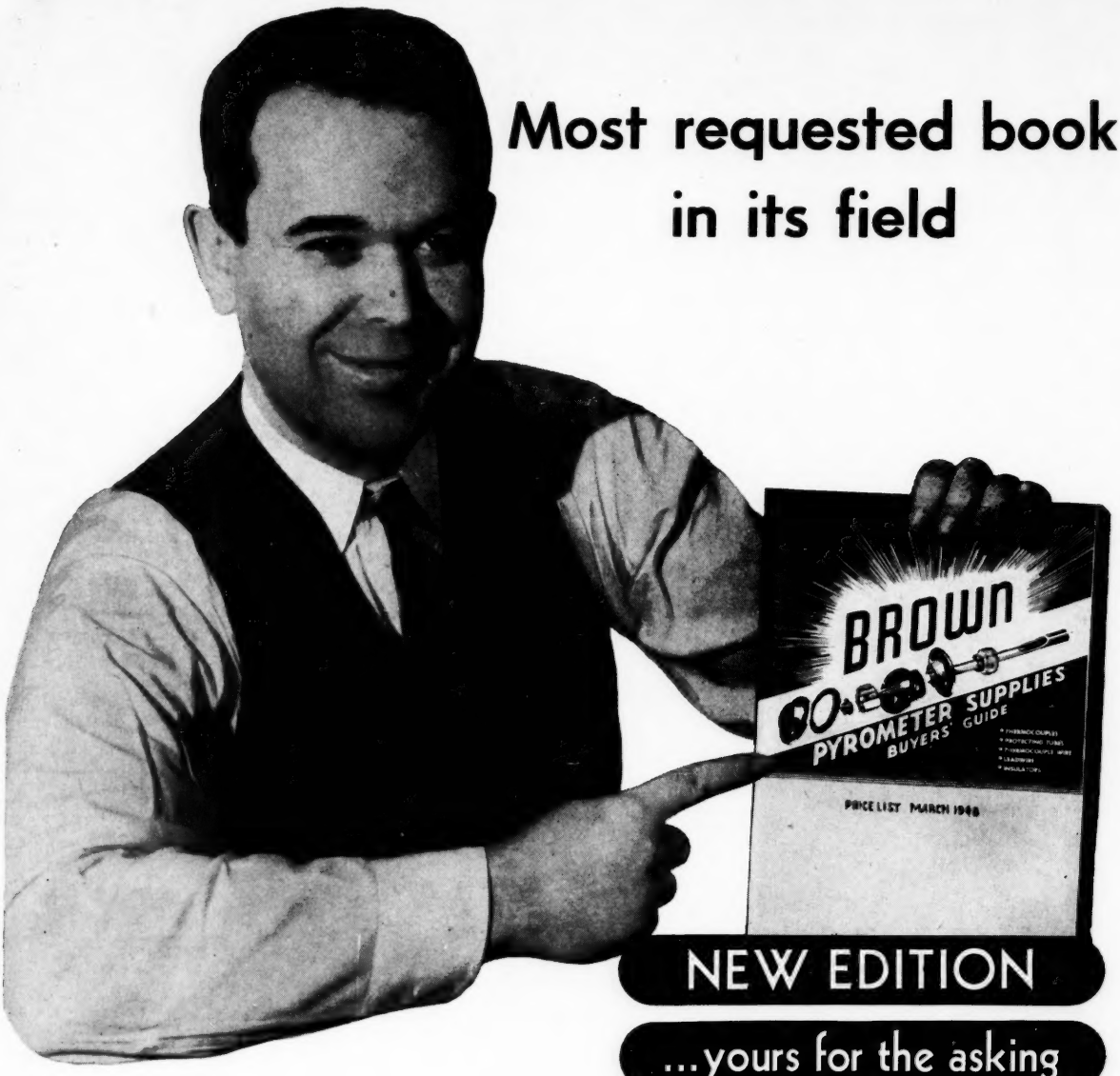

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Metals Review

THE NEWS DIGEST MAGAZINE

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VOLUME XXI, NO. 5 — **MAY, 1948**

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MEMO to ASM Metal Men

EVEN NOW, you will want to make a reminder on your calendar for the great technical program that is under way for presentation at the 30th annual National Metal Congress, to be held with the National Metal Exposition in Philadelphia next October.

You have attended many fine technical sessions but this Fall Meeting will be a topper. Each day, additional papers are being received at national headquarters of A.S.M. From all of these, thirty outstanding papers will be selected for presentation in Philadelphia.

While the Exposition will open on Monday, October 25 (and run through Friday, October 29), technical sessions will get under way on Saturday and Sunday, October 23 and 24 with an important seminar on the fundamentals of cold working.

In addition to the excellent series of regular technical sessions that are scheduled for presentation starting Monday, October 25, there will be three splendid educational lectures. On Monday and Tuesday, October 25 and 26, a series of four lectures will deal with the properties of materials for design. Nine experts will participate in this series.

Metallurgy and magnetism will be discussed in a series of three daily lectures on Monday, Tuesday and Wednesday, October 25, 26 and 27. Four daily sessions will take up recrystallization and grain growth in metals. These will be held on Tuesday, Wednesday and Thursday, October 26, 27 and 28.

Leading metal experts from both the nonferrous and the iron and steel industries are participating in these meetings. Every effort will be made to bring representative companies from these fields into the Metal Exposition to provide a comprehensive exhibition of metals, equipment and product information for your convenience.

In short, outstanding plans are in the making for *you*—make a memo now to attending this great event—National Metal Congress and Exposition, Commercial Museum and Convention Halls, October 25-29, Philadelphia.

Watch Metals Review and Metal Progress for Hotel Reservation Forms

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Testing Instrumentation and Inspection

An Analysis of a Year's Literature

By T. P. Nordin
Research Engineer, Battelle Memorial Institute

TESTING and inspection procedures in use today have several specific purposes.

First, physical test results are tools in the hands of the designer without which he is unable to make optimum use of materials at his disposal. Second, physical tests also augment preliminary design and stress analysis to narrow the ever-existing gap between theoretical analysis assumptions and the actual service strength of finished machinery. Third, when a design has been completed and is in production, physical tests are still needed to prove all critical parts in order to insure uniformity.

Often, the feasibility of manufacturing a product depends upon the structural efficiency with which the materials are used. An example of this is commercial aircraft, where extra pounds of material not used to the utmost decrease the allowable pay load, and reduce the revenue.

Existing testing and inspection methods can be broken down into two general types—destructive and nondestructive tests. A destructive test is one in which service life is impaired or the integrity and dimensions of the original specimen are destroyed as a whole, or in part, so that the specimen is no longer useful. Tensile, hardness, abrasion, fatigue, and creep tests are examples of this type. In contrast, the nondestructive test does nothing to impair the usefulness of the specimen. Destructive tests are usually relegated to the research and development section and nondestructive tests are assigned to the inspection department.

A third type of test, which fits into neither of these categories, is the proof test. It may be termed both destructive and nondestructive, depending upon the behavior of the test specimen. It is designed to reject and destroy parts which do not meet certain specifications, and to leave in serviceable condition those parts which do meet these requirements. An example is the proof loading of tension members made up of tubing with flash welded fittings on both ends. In order to guarantee meeting minimum strength requirements, all such parts are subjected to a minimum load which will destroy all substandard parts and yet not damage those that are standard.

Destructive tests usually measure the character of physical deformation of parts or material which results from the absorption of mechanical work or energy. In the tensile test, the ultimate strength is that level of stress or mechanical energy absorption at which fracture of the material occurs. Such allied measurements as yield strength, per cent elongation, and per cent reduction of area are a direct measure of the deformations caused by the absorption of that energy. Impact tests, or other dynamic-type tests, usually measure the ability of the material (in a particular size and shape) to absorb kinetic energy, and serve to indicate a material's shock resistance.

High-Temperature Tests

Highly significant among recent developments in destructive testing has been the growing use of high-temperature tensile and creep tests. These developments stem from the requirements of coal and gas turbines and of very high-speed aircraft, whose performance is dependent upon materials which can withstand operating temperatures in excess of 1500° F. To withstand these temperatures, certain metals and other materials heretofore not considered practical or economically feasible are being given serious consideration. New and radically different test methods are being developed, such as that which Westinghouse is now using on gas-turbine materials (9-43, May 1947)*. In this test, a disk of metal 1 ft. in diameter is constantly rotated at 3500 r.p.m. while being heated to 1400° F. until failure occurs.

Much attention has been directed to methods for increasing the speed of high-temperature testing. A. W. Brunot (9-102, Sept. 1947) described a method whereby one man can conduct 35 separate high-temperature tensile tests in 8 hr. The short-time tests are, however, of little value for general high-temperature evaluation.

An increasing amount of pertinent literature is being made available to those interested in measuring creep (9-110, Oct. 1947) and in the conduct of tests and evaluation of creep-test data (9-119, Oct. 1947; 9-139, Nov. 1947; 9-71, Aug. 1947).

Fatigue Failure

For 75 years, the nature and mechanism of fatigue failure has been a subject of conjecture and theorizing. The generally accepted concept that stress reversals below the endurance limit (that level of maximum cyclic stress below which pure fatigue failure will occur in the absence of corrosion, stress concentration, or similar factors) have little, if any, effect on the material tested, has become a subject of close examination.

Although a considerable quantity of data on the fatigue life of various materials has been accumulated, little, if any, has been sufficiently correlated with fatigue in structures so that it can be useful to the designer. Results of some work in correlating fatigue data with tensile and compression tests are reported in a French article (9-54, June, 1947). The author has produced mathematical relationships correlating the different types of tests based on theoretical calculations. Surface conditions and geometric sizes and shapes have been recognized for some time as important factors influencing fatigue life. The benefits of shot-peening, electropolishing, and surface hardening are familiar, and some interesting aspects are discussed by J. F. Caswell (9-36, April 1947).

The problem of accurate determination of dynamic loads imposed during the fatigue test has stimulated improvement of test equipment. D. J. Lazan (9-69, July, 1947) described a new below-resonance centrifugal-force type of testing machine having an inertia-force compensator for insuring the constancy of repeated applied loads. The use of electric strain gages and associated instrumentation for observing the magnitude and type of loading is receiving wide approval. Difficulties in testing gas turbine buckets in reverse bending have been solved through the use of a pneumatic testing machine (9-11, March 1947).

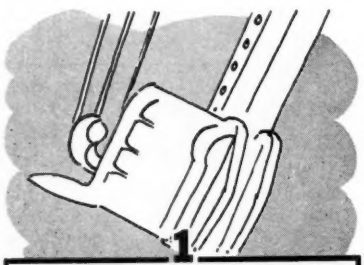
The prediction of fatigue life of machinery and structures subjected to a wide range of stress reversals has

(*Turn to page* 5)

* Literature references are cited by the corresponding item number in the *Review of Current Metal Literature* instead of repeating entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month



ORE BENEFICIATION

1a—General

1a-12. Heavy-Density Separation—A Review of Its Literature. John W. Hyer, Jr. *Quarterly of the Colorado School of Mines,* v. 43, Jan. 1948, p. 1-94.

94 references.

1a-13. Heavy-Media Separation Processes—Present Status and Potentialities. G. B. Walker. *Mining Congress Journal,* v. 34, March 1948, p. 38-41, 44-47.

A thorough analysis of processes developed by American Cyanamid. Descriptions of several existing heavy-media plants.

1b—Ferrous

1b-7. Reduction of Phosphorus Content in Iron Ore and Concentrate From Iron Mountain, Mo. H. Kenworthy. *Bureau of Mines, Report of Investigations* No. 4199, Feb. 1948, 20 pages.

Results of work done for the purpose of reducing the phosphorus content of the concentrate produced by Ozark Ore Co., which is sometimes as high as 0.40%, to less than 0.18%. Satisfactory results were obtained by a combination of several conventional ore-dressing processes.

1b-8. Enrichissement des Minerais de Fer Oolithiques Pauvres du Bassin Lorraine-Luxembourgeois. (Enrichment of Low-Grade Oolithic Iron Ores from the Lorraine-Luxembourg Basin.) N. Stoll. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 221-227.

Results of laboratory work on beneficiation. Magnetic separation was satisfactory for all types except ferriferous cement. The roasted reduced ore must be ground very fine for best results.

1c—Nonferrous

1c-27. Concentration of Lake Valley Mines Oxide Manganese Ore From Deming, N. Mex. K. C. Dean, H. G. Iverson, and J. A. McAllister. *Bureau of Mines, Report of Investigations* No. 4186, Feb. 1948, 8 pages.

Methods and results in an investigation of an ore reported to be representative of the type that would be mined for mill feed. Sample tested was found to be amenable to beneficiation by ore-dressing methods for the production of products that, when sintered, assayed over 44% Mn.

1c-28. Sidney Mine, Pine Creek Area, Shoshone County, Idaho. Robert M. Gammell and Robert J. Hundhausen. *Bureau of Mines, Report of Investigations* No. 4188, Feb. 1948, 11 pages.

Beneficiation tests on Zn and Pb concentrates as produced by selective flotation.

1c-29. Concentration of Urania Tin-Tungsten Ore From Bolivia, South America. G. M. Potter and W. G. Sandell. *Bureau of Mines, Report of Investigations* No. 4185, Feb. 1948, 10 pages.

Methods and results in an investigation of a complex Sn-W ore from the Urania mine (no uranium present). Best results were obtained by sulphide flotation followed by tabling and retreatment of the table products.

1c-30. Amalgamation of Some Alloys of Gold, Silver and Copper. Douglas Rennie Hudson. *Nature,* v. 161, Feb. 21, 1948, p. 288-289.

The thickness of the film required to make the surface greasy to the touch and lustrous in appearance was investigated for gold-rich alloys used in jewelry, for some silver alloys, and for some bronzes. Films of an order of thickness near 10^{-4} cm. were found sufficient. The results are said to be of value for amalgamation of gold concentrates.

1c-31. Synthesis of Some Sulpharsenites of Silver in Alkali Sulphide Solutions. Rene Beland. *Economic Geology and the Bulletin of the Society of Economic Geologists,* v. 43, March-April 1948, p. 119-132.

Smithite, proustite, xanthoconite, wire silver, and argentite were prepared in concentrated alkali sulphide solutions at temperatures below 500° C. and pressures below 900 atm. The solutions were found to be chemically compatible with the gangue minerals found in epithermal silver veins. Therefore, the principal carriers for primary ruby silver ores are thought to be alkali sulphide solutions. The experimental results may explain some features of primary silver ores. 29 ref.

1c-32. Nchanga Consolidated Copper Mines, Ltd., Northern Rhodesia, South Africa. Part I—Development and Pilot Plant Operations. H. A. Talbot. *Deco Trefoil,* v. 12, March-April 1948, p. 5-12.

Location and history of the mine; mineral composition; ore reserves; pilot-plant operations—1940 to 1945 inclusive; the crushing plant; grinding and classification; flotation and flotation reagents; conditioning; filtering and de-sliming of concentrates; concentrate handling; tailings disposal; and sampling and assaying. (To be continued.)

SMELTING, REDUCTION and REFINING

2a—General

2a-6. Vacuum Metallurgy. Harold A. Knight. *Scientific American,* v. 178, April 1948, p. 173-175.

Melting metals in the absence of gases to produce high-quality products.

2b—Ferrous

2b-57. Contribution a l'Etude de la Durée des Lingotieres. (Contribution to the Study of the Life of Ingot Molds.) Robert Stumper. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 228-233.

Metallographic examination of a number of molds of the same type indicated that cracking of "synthetic" cast iron could be attributed to a predominantly pearlitic structure. The method of treatment of this type of cast iron produces super-heated, oxidized cast iron, rich in gas. 12 ref.

2b-58. Nagra Erferenheter Vid Sintring Med Okat Undertryck. (Some Notes on Vacuum Sintering.) Sven Jansson and Christer Danielsson. *Jernkontorets Annaler,* v. 132, no. 1, 1948, p. 15-26.

Iron ore for production of high-phosphorus pig iron for the basic bessemer process was sintered commercially under 3 degrees of vacuum. It was found that the rate of sintering increases in proportion to the square root of the vacuum, that relative resistance to passage of air is changed only slightly, that energy consumption increases in proportion to the vacuum, and that quality of the sinter is not affected.

2b-59. The Use of Oxygen in Open-hearth Furnaces. E. C. McDonald. *Iron and Steel Engineer,* v. 25, March 1948, p. 37-43; discussion, p. 43.

Data obtained from experience in making 770 heats using a combination of oxygen through the burners, and direct injection into the bath by means of a submerged pipe or lance. Burner design and arrangement of piping. The two problems still to be solved are refractory life (in the roofs) and fumes

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TESTING INSTRUMENTATION

been a difficult, if not impossible, task. Marcel Prot (9-171, Dec. 1947) argues from theoretical considerations and experimental data that when fatigue testing is conducted with the stress magnitude increasing directly with the time throughout the test, instead of with constant stress, the stress at failure will be equal to the time multiplied by a constant for the particular specimen.

Hardness Tests

Hardness may be defined as the resistance offered by materials to penetration of an indentor. The indentation hardness test has not yet been completely analyzed in detail on the basis of the mathematical theory of plasticity. The theory of wedge indentation—the first step in such an analysis—was discussed by Hill, Lee, and Tupper (9-29, April 1947). Such analyses may prove useful in extending the understanding of hardness tests.

Perhaps the most widespread application of hardness tests is in a determination of correlated tensile strength. Although this relationship has proven valid for certain ranges of hardness and tensile strength for specific materials, there has been a tendency to extrapolate the results beyond feasible limits. When, however, the hardness measurements are used for correlation with other hardness values, the test is quite reliable as well as useful.

Tendencies in hardness measurements during the past year have been directed toward the development of specialized equipment. New microhardness testers have been developed to measure the hardness of constituents and grains visible at great magnification in mounted, polished, and etched metallographic specimens (9-148, Nov. 1947). A new portable hardness tester is a British instrument. Hot-hardness measurements are becoming important in connection with high-temperature alloys and will require new types of testing equipment. Some aspects of hot-hardness testing with particular emphasis on the requirements are discussed by K. G. Robinson (9-66, July 1947).

Impact Testing

Impact tests have been used for many years as a means of evaluating energy absorption to distinguish tough or shock resistant materials from those which are brittle. This type of test has received close attention during the past year in connection with time, temperature, and velocity of loading, and their influence on the failure of structures. Tension and bending impact tests are being used to study the fundamental mechanism of such failures. William H. Hoppmann (9-86, Sept. 1947) discusses the velocity aspect of tension-impact tests and the use of the guillotine type of testing machine developed for the Navy to study the effect of velocity of impact upon materials and structural elements. The T. von Karman theory of the propagation of plastic deformation in solids is discussed together with the "critical velocity" of impact.

Research has also introduced another concept into the field of velocity impact testing—that of "transition temperatures". The transition temperature is that temperature at which "ductile" type failures change to "brittle" failures. Results of tests have shown that, for some rimmed or semi-killed steel, this transition occurs between 0 and 100° F., and is vastly affected by the section of the specimen, and by the degree of stress concentration. Poor design and the designer's acceptance of apparently good notched-bar behavior in tiny conventional specimens instead of insisting upon full-scale tests that would reveal poor behavior, are proven contributing factors in heretofore inexplicable failures.

Inspection Tests

Since all inspection procedures must be of such a nature that they do not harm the manufactured product, nondestructive tests are usually used for this purpose. Geometric size and shape measurements with the aid of mechanical calipers and gages have been made for many years. Only during the past few years have new and different types of nondestructive tests made their appearance. Possibilities of these new nondestructive tests have been investigated with a view to reducing inspection time and cost.

Certain basic and essential features are common to nearly all nondestructive tests. Some are directly applied, as in mechanical gaging or visual inspection. Most others depend upon a transfer of energy. The manner in which this energy is modified by the test object is vital to the determination of that property with which the test is concerned. Some typical properties actually measured by nondestructive test methods include:

1. Geometric properties such as size, shape, and thickness.
2. Mechanical properties such as density, hardness, and elasticity.
3. Properties of structure and composition including grain size, degree of grain orientation, segregation, and inclusions.
4. Absorption and reflection properties such as transparency, scatter, and reflection of energy beams.
5. Electrical and magnetic properties such as electrical conductivity, magnetic permeability, eddy current, and hysteresis losses.
6. Thermal properties.

Many of these properties are interrelated or can be correlated to others so that the measurement of one property determines the value of another. These interrelations make nondestructive tests useful as inspection processes. Unfortunately, these very correlations are also often misinterpreted and have caused the rejection of millions of dollars worth of usable parts. It is vitally important that nondestructive tests be initially correlated with the service performance and designed to measure the specific property in question.

The mechanical gages and visual comparators in use today have reached a high degree of perfection; however, they represent only a small portion of the whole field of nondestructive test methods. More recent newcomers to the field are magnaflux and X-ray inspection tests. These two methods, through their widespread use during the war years to inspect machined parts and castings respectively, have established themselves as accepted and fairly reliable inspection tests. Their continued use has broken the ice for more recently developed nondestructive methods such as the supersonic or mechanical vibration test, and the electromagnetic induction test.

Supersonics

General Motors and Sperry Instrument Co. have recently commenced to manufacture supersonic test instruments having wide versatility (11-103, Sept. 1947; 12-202, Jan. 1947).

Many thorough discussions of supersonics as applied to industry are to be found in the past year's literature (12-42, April 1947; 12-64, May 1947; 12-94, July 1947; 12-165, Oct. 1947, and others). For satisfactory performance of this test, certain precautions should be taken. Intimate coupling of the transmitter and pick-up to the test object is highly important in order that very little energy be lost at the interface between the quartz transmitter and the surface of the test object. This usually means that the test object must have a flat, machined surface and be coated with oil or grease as a coupling medium. If the method is to be used to locate laps, seams, or cold shuts, it is particularly important that these defects, if possible, be placed in a direction perpendicular to the propagation of the sound waves so as to minimize scatter of the incident energy.

An excellent application of the supersonic test method is in measuring the distance between the parallel sur-

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emitted from the stack during lancing. Design changes made in an attempt to increase roof life have so far been largely unsuccessful. Spray-tower washing for fume and dust removal has been quite successful. The benefits derived from use of oxygen. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 23, 1947.)

2b-60. Use of Graphite as a Substitute for Pig Iron. R. J. Meyers. *Iron and Steel Engineer,* v. 25, March 1948, p. 104. A condensation.

On several occasions, graphite was substituted for pig iron and the amount of high-silicon scrap was increased to compensate for the lower silicon content of the charge. Analysis indicates that approximately 7% per ton of metallic charge can be saved by substituting graphite or coke for most of the pig iron in the standard charge. However objectionable features were weighed against the lower cost and it was decided to return to pig iron whenever available. (Presented at meeting of Open Hearth Division, A.I.M.E., Philadelphia, Nov. 7, 1947.)

2b-61. Comments on Furnace Practice in Western Europe. W. B. Wallis. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 46N-50N.

Ferro-alloys; smelting furnaces; melting furnaces; electrodes; and future developments. Deals only with the iron and steel industry.

2b-62. Sponge Iron in Japan. Theo. L. Johnston. *Bureau of Mines, Information Circular* No. 7440, March 1948, 12 pages.

Of the various methods used, the rotary-kiln method was the most important and accounted for 646,000 metric tons from 1939 to 1945. Various difficulties encountered. Most of the ores contained small amounts of Ni and Cr, which were recovered in the product which was used for alloy-steel production in the electric furnace. Attempts to make sponge iron by the Swedish sagger method were successful in Manchuria, but unsuccessful in Japan itself on account of low-grade ores and coals available for the latter. Use of electric furnaces for smelting iron ore.

2b-63. Melting of Quality Basic Electric Steel. T. V. Simpkinson. *Canadian Mining and Metallurgical Bulletin,* v. 41, March 1948, p. 127-137.

A brief history of the electric-arc furnace process of steelmaking. The greater relative importance of this method of steel manufacture to the Canadian steel industry, as compared with its importance in the steel industry of the U. S. The scope of the process; difficulty of obtaining melting stock low in alloy content. The physical chemistry of steelmaking, with emphasis on oxidation, deoxidation, and the role of hydrogen. Carbide-type and silicon-type slags. (To be presented at annual meeting, Canadian Institute of Mining and Metallurgy, Vancouver, B. C., April 1948.)

2b-64. Electric Hot Topping Steel Ingots. E. S. Kopecki. *Iron Age,* v. 161, March 25, 1948, p. 80-86.

Method offers the steelmaker a means for obtaining an increased and more consistent yield of sound ingot metal. Proved economically and metallurgically practical, the process has already been applied in the manufacture of a wide variety of steels and high-temperature alloys.

2b-65. Combustion Oxygen in the Openhearth. *Iron Age,* v. 161, March 25, 1948, p. 87-89. Condensed from "Operation of Oxygen-Enriched Openhearth Furnaces," by J. S. Marsh.

Experiences of Bethlehem Steel Co. in making some 400 experimental heats with burner injection of oxygen. (Presented at annual A.I.M.E. meeting, held recently in New York.)

2b-66. Estimation of the Composition of Oxidizing Slags in Electric-Arc Furnaces. (In Russian.) A. M. Samarin, A. Yu. Polyakov, and L. A. Shvartsman. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1639-1648.

In order to estimate the slag content, it is necessary to know the oxygen content, which in turn is based on the carburization-decarburization equilibrium and the ferrous oxide activity. How to determine slag composition on the basis of charts developed by the author. 11 ref.

2b-67. Tillstandsdiagram för Basiska Stalslagger, Litteraturöversikt. (Phase Diagrams for Basic Steel Slags; Literature Review.) Holger Pettersson. *Jerkontorets Annaler,* v. 132, no. 2, 1948, p. 42-56.

Available diagrams are described and discussed with regard to Swedish basic open-hearth slags. 51 ref.

2b-68. Zur Kenntnis der Reduktion von Eisenoxyden mit Wasserstoff und Kohlenmonoxyd. (Reduction of Iron Oxides by Hydrogen and Carbon Monoxide.) (Continued.) H. J. Leibu. *Schweizer Archiv,* v. 14, Feb. 1948, p. 49-59.

The relationship between the temperature and course of the reaction. (To be continued.)

2b-69. The Use of Sponge Iron for Steel Production in Sweden. M. Tigerschiold and S. Eketorp. *Metallurgia.* v. 37, Feb. 1948, p. 167-177. Translated and condensed from a paper by M. Tigerschiold and from some notes from a lecture by S. Eketorp, Sheffield, Oct. 1947.

The main developments of the sponge-iron process. The Hoganäs and Wiberg methods, with particular attention to the economic aspects of their application. Calculation of the composition of sponge iron from different raw material; production costs of sponge iron; earlier sponge-iron melting practice; melting and cost calculations for steel made from sponge iron; comparison of the value of sponge and pig irons; and considerations affecting the method of production and the raw material. 21 ref.

2b-70. Vitamins for Iron. *Inco,* v. 22, Spring 1948, p. 22-23.

Inoculation of gray-iron castings with "Nisiloy", a product containing approximately 60% Ni, 30% Si, and 10% Fe, to improve machinability, and achieve other beneficial results.

2b-71. Sponge Iron and Iron Powder. J. F. Drapeau. *Iron Age,* v. 161, April 8, 1948, p. 92-94.

A continuous sponge iron-iron powder setup, for converting iron scale to high-quality annealed and unannealed iron powders. Plans for the introduction of new and improved ferrous powders manufactured by procedures not previously employed in the industry.

2c—Nonferrous

2c-20. Influence du Carbonate de Soude sur la Vitesse de Reduction d'une Blende Supergrillée par le Coke. (Effect of Sodium Carbonate on the Rate of Reduction of a Zinc Blende Exhaustively Roasted With Coke.) Claude Decroly. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 234-244.

Addition of Na_2CO_3 increased the rate of reduction markedly at temperatures below 1100° C. The rate and amount of reduction for a given time increase with the Na_2CO_3 content of the charge, contents of 0.10% by weight of the blende being most effective. The usual theoretical concepts concerning the mechanism of reduction of zinc oxide and the role of the Boudonard reaction are confirmed.

2c-21. Further Notes on Converter Practice at Rio Tinto. H. R. Potts. *Bulletin of the Institution of Mining and Metallurgy,* March 1948, p. 1-18.

Information was first given by the present author in a paper published in 1929. Because of the large number of changes since then, the operations are again described. Average composition of the matte is 22.88% Cu, 24.50% S, and 42.60% Fe. Redesign of wind boxes; reduction in thickness of magnetite layer used to protect the tuyere linings; fundamental reactions of converter operation; disposal of by-products; converter refractories; elimination of As and Bi; cleaning of converter mouths; and casting of copper. Operating data.

2c-22. Copper Refining. *Metal Industry,* v. 72, March 12, 1948, p. 203-205.

Plant, equipment, and procedures of Murex, Ltd., Rainham, Essex, England.

2c-23. Platinum Metals; A Survey of Their Production, Properties and Engineering Uses. Part I—Extraction, Melting and Working. Part II—Properties. Part III—Applications. Part IV—Alloys. C. A. H. Jahn. *Metal Industry,* v. 72, March 5, 1948, p. 183-186; March 12, 1948, p. 206-209; March 19, 1948, p. 228-230, 234; March 26, 1948, p. 249-250, 254; April 2, 1948, p. 267-269.

An illustrated survey. (Recently presented at meeting of Midland Metallurgical Societies.)

2c-24. Copper and Brass Production. J. Sykes. *Metal Industry,* v. 72, March 19, 1948, p. 223-226.

British plant for refining, casting, and rolling copper and brass.

2c-25. The Rarer Metals. *Metal Industry,* v. 72, March 26, 1948, p. 246-248.

Ore beneficiation; smelting; reduction, and refining; Thermit welding; and powder metallurgy. Metals treated include W, Mo, V, Ti, Mn, Cr, Co, Cb, Ta, Zr, and B.

2c-26. Production of Thorium, Zirconium and Uranium. George Meister. *Metal Progress,* v. 53, April 1948, p. 515-520.

The various methods of each.

2c-27. Trail Refuses to Trail in Chemical Pioneering. Sidney D. Kirkpatrick. *Chemical Engineering,* v. 55, April 1948, p. 96-99.

Many unique processes peculiarly applicable to local raw materials and facilities are described and illustrated. Most notable include use of byproduct oxygen in contact sulphuric acid production; gasification of coal; and zinc and lead smelting. Other striking advances have been made in the technology and production of nitrogenous and phosphatic fertilizers.

2d—Light Metals

2d-7. German Methods of Producing Alumina and Aluminum. *Light Metal Age,* v. 7, April 1948, p. 10-14.

Based on several B.I.O.S. reports from which flow diagrams are reproduced.

For additional annotations indexed in other sections, see:

2c-25; 4b-27; 27b-22; 27d-7.

TESTING INSTRUMENTATION

faces of parts or sheet metal. The Sonigage (11-103, Sept. 1947) is a simple, accurate device for rapidly determining sheet metal thickness and part dimensions with access to only one surface.

Magnetic Particle Testing

Magnetic particle testing has become one of industry's standard inspection methods in recent years. Its widespread use during the last war to detect fatigue and grinding cracks has brought about many new applications. M. H. Mueller and W. E. Yeast (12-59, May 1947) discussed the use of magnetic particle inspection equipment to reduce the number of rejected chromium-plated tools used in the manufacture of small arms ammunition. S. L. Henry (12-141, Sept. 1947) discussed magnetic particle inspection of weldments.

The magnetic particle test (or magnaflux) is primarily qualitative and —as with most other nondestructive tests —is subject to false or spurious indications. The method, therefore, requires training in the interpretation of flaw indication. These factors tend to make the detailed examination of the entire surface of each product a time-consuming and sometimes costly operation, and have restricted the use of this valuable tool. The Magnaflux Corp. has recently made a determined effort to reduce this inspection time by developing semi-automatic equipment (12-104, July 1947). Fully automatic magnetic equipment is in the process of development.

Penetrating Radiations

Penetrating radiations—beta rays, gamma rays and X-rays—have been used for some time as a means of nondestructive inspection. Almost every foundryman is familiar with X-ray inspection to reveal the presence of sand and porosity in castings. The contribution X-ray inspection has made to improving foundry practice is indisputable (12-142, Sept. 1947) but further research needs to be directed toward relating such variables as pouring temperature, gas porosity, and inclusions with performance characteristics as determined by X-ray examination.

The protection of personnel from harmful radiation has always been a problem. The application of infrared storage phosphors may not only remove the danger of X-ray radiation but may eliminate entirely one of the greatest expenses of radiography, namely, film (12-76, June 1947). This article mentions the possibility of a new field, "flash fluoroscopy", and presents graphs and charts showing the characteristic behavior of the infrared phosphors as compared to X-rays; photographs compare radiographs and phosphorgraphs. The recent development of the betatron (12-15, Feb. 1947) and its application (12-191, Jan. 1947) is a major contribution to increasing the speed, flexibility, and definition of defects as revealed by penetrating radiation.

Beta-ray thickness measuring equipment has also been developed. It incorporates counting and integrating circuits which respond to the absorption of beta rays by steel strip moving over a radio-strontium source (12-181, Nov. 1947). Sheets can be automatically sorted by a mechanical gage after cutting. A similar device, the X-ray Flicker Photometer, developed by General Electric Co. (11-17, March 1947) employs an X-ray source in combination with phototubes.

T. P. Nordin, Jr., is associated with the engineering materials laboratory of Battelle Institute, where most of his work is concerned with research in testing, inspection, and instrumentation. He holds a Bachelor of Science degree from Massachusetts Institute of Technology with a major in engineering materials. Before joining the Battelle staff in early 1947, he worked as a test engineer and stress analyst for the Firestone Tire and Rubber Co., and earlier as a test engineer with the Douglas Aircraft Co.

Electromagnetic Tests

Electromagnetic induction - type nondestructive tests take many forms. The differences usually lie in the pick-up or energy-detecting device and the manner in which the detected energy is treated. The energy source—a current-carrying coil—induces a flux field in the test specimen. Changes in the flux field cause currents to flow and thereby set up potential gradients. The electrical and magnetic properties of the test object determine the behavior of the flux field, current paths, and potential gradients, and are related in a rather complex manner to the physical and chemical properties of the test object. Such properties as hardness, depth of casehardening, grain size and orientation, condition of residual stresses, and geometric size and shape influence the test specimen's hysteresis and eddy current losses in some definite relationship.

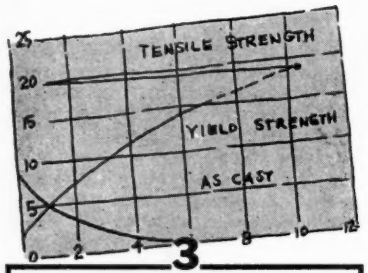
A rather widely used electromagnetic induction testing instrument is the Cyclograph. Modifications of this instrument are used by many manufacturers for maintaining uniformity of products. One novel use is in the inspection of mine hoist cable (12-154, Sept. 1947). The device checks continuously any changes in stress distribution and magnitude as well as failures within the cable. Another inspection device, the Ferrograph, based on the principles of electromagnetic induction, has been announced by the manufacturers of the Cyclograph (12-196, Jan. 1947).

Mechanical Gaging

The number and variety of nondestructive tests based upon mechanical and visual principles preclude their detailed discussion in this article. Such tests include profilometers or surface analyzers, visual comparators, mechanical gages, reflection meters, and many so-called electronic comparators. New improvements make their appearance each year. A discussion of surface finish requirements with notes on several mechanical and visual nondestructive tests was written by J. R. Ford (11-27, April 1947). A new method of determining flatness is described by R. Mariner and W. O. Jennings (12-166, Oct. 1947).

The most significant advances in the field of mechanical gaging can be attributed largely to instrumentation of previously used methods. Such instrumentation has not only increased the usefulness and speed of these tests but has provided suitable work for the physically handicapped. The Limitron (12-121, 12-133, Aug. 1947) is one such device which uses electrical measuring equipment in combination with mechanical gages to incorporate the best features of each. Another such electromechanical de-

(*Turn to page* 9)



3a—General

3a-30. Fatigue Characteristics of Rotating-Beam Versus Rectangular Cantilever Specimens of Steel and Aluminum Alloys. F. B. Fuller and T. T. Oberg. *A.S.T.M. Advance Print* AP4, 1947, 12 pages; discussion, p. 9-12.

Results of fatigue tests conducted in Krouse vibratory nonrotating cantilever beam and R. R. Moore rotating-simple-beam fatigue-testing machines. Specimens were machined from extruded shapes of 75 S-T, 24 S-T, 14 S-T, and R 303 aluminum alloys and from S.A.E. 4130, flat, steel plate of several degrees of hardness.

3a-31. The High-Temperature Fatigue Strength of Several Gas Turbine Alloys. P. R. Toolin and N. L. Mochel. *A.S.T.M., Advance Print* AP9, 1947, 17 pages; discussion, p. 16-17.

Results of a program to determine fatigue characteristics of many proposed gas turbine alloys at temperatures of 1200° F. and above. Results are given on alloys whose compositions range from the older 18% Cr, 8% Ni type to the newer more highly alloyed materials. Both wrought and precision-cast (lost-wax process) materials were tested. High-temperature fatigue machine used in this study. 18 ref.

3a-32. Magneto-Spin Resonance in Ferromagnetic Materials Induced by Waves in the Centimeter Range. (In Russian.) E. K. Zavoiskii. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 17, Oct. 1947, p. 883-888.

Phenomenon was investigated in a series of ferromagnetic alloys such as electrolytic nickel, transformer iron, and alloys of the "Mishima" type (composition not given).

3a-33. Influence of the Arrangement of Magnetic Moments on the Magnetic Properties of Polycrystalline Ferromagnetic Materials. (In Russian.) M. V. Dekhtyar and G. M. Raiskaya. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 17, Oct. 1947, p. 911-914.

Results of a correlation of experimental data. 10 ref.

3a-34. On Creep and Relaxation. Part II. B. Gross. *Journal of Applied Physics*. v. 19, March 1948, p. 257-264.

In a previous paper the theory of the transient effects caused by the sudden application of constant load or constant deformation was developed. In the present paper, the theory of the steady-state behavior under alternating load and deformation is given. Relations are established between loss factor, storage factor, distribution functions, and Laplace transforms of the creep, and of the relaxation, functions. 25 ref.

3a-35. Slow Neutron Velocity Spectrometer Studies of Cu, Ni, Bi, Fe, Sn and Calcite. W. W. Havens, Jr., L. J. Rainwater, C. S. Wu, and J. R. Dunning. *U. S. Atomic Energy Commission,* MDDC-1645, Sept. 22, 1947, 31 pages.

Data reviewed. 37 ref.

3a-36. Theory of the Mechanical Properties of Solids. (In Russian.) V. Zhdanov and V. Konusov. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 17, Nov. 1947, p. 976-985.

Equations of state and modulus of elasticity for single-atom lattices are proposed. The moduli and the criteria of lattice stability are investigated on the basis of potential-energy parameters.

3a-37. Diffusion in Molten Metals. (In Russian.) A. M. Samarin and L. A. Shvartsman. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1649-1651.

Applies the basic Stokes-Einstein formula. Results of experiments on Li, Na, K, Rb, Cs, Ca, Sr, Ba, Au, Ga, Zn, Pb, Tl, Cd, and Ag show that theoretical coefficients of diffusion do not differ greatly from experimental ones.

3a-38. Interpretation of the Coefficient of Strength of Metals. (In Russian.) I. A. Oding. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1713-1719.

Coefficient is derived from Nadai's equation for plastic deformation. It is assumed to be a composite value composed of modulus of elasticity and coefficient of relaxation.

3a-39. The Adiabatic Temperature Changes Accompanying the Magnetization of Some Ferromagnetic Alloys in Low and Moderate Fields. L. F. Bates and E. G. Harrison. *Proceedings of the Physical Society,* v. 60, March 1948, p. 213-225.

The method of Bates and Weston for measuring the small heat changes which occur as a ferromagnetic substance is taken through a single hysteresis cycle was extended to seven ferromagnetic alloys. In every case cooling was initially observed as the magnetization of the specimen was reduced from its maximum value. Indications were found that large changes in thermomagnetic properties are caused by small changes in composition, particularly when similar to that of invar. Results in terms of modern domain concepts of ferro-magnetic processes.

3a-40. Damping Capacity of Metals. E. V. Potter. *Bureau of Mines, Report of Investigations* No. 4194, March 1948, 48 pages.

Work which has been done as described in the literature. Various test methods, their theory and accuracy; fundamental mechanisms contributing to energy losses and their relative magnitudes; and the relation between damping capacity and other properties of materials. Also discusses the various units for expressing damping capacity; the choice of testing methods; the importance of damping capacity in engineering; and practical applications of damping-capacity measurements. 49 ref.

3a-41. Theory of the Anomalous Skin Effect in Metals. G. E. H. Reuter and E. H. Sondheimer. *Nature,* v. 161, March 13, 1948, p. 394-395.

In order to put Pippard's provisional theory of the anomalous effects on a more rigorous basis, his equations are reformulated using the methods of the modern electron theory of metals. Explicit solutions are obtained which make it possible to give a quantitative account of the phenomena to be expected over the whole frequency and temperature range.

3a-42. Selection of Engineering Materials for Coke Plants. C. F. Pogacar. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 439-442.

Important properties of metals usually considered in their selection. Examples; weaknesses in each case and corrective measures. (To be continued.)

3a-43. A Summary of Heat Resistant Alloys from 1200 to 1800° F. Nicholas J. Grant, A. F. Frederickson, and M. E. Taylor. *Iron Age.* v. 161, March 18, 1948, p. 73-78; April 8, 1948, p. 75-81; April 15, 1948, p. 84-93.

Conducted as a project of the U. S. Navy Bureau of Ships, this summary correlates and evaluates data produced over the past seven years by various industrial and governmental sources. Relative stress-rupture data, and creep properties at various temperature levels. Compositions of some 53 alloys, together with physical property data for most of the alloys. Effects of temperature, grain size, composition, and aging on rupture and creep properties. The degree of control necessary to standardize these variables. Stress-to-rupture and elongation values for some of the more promising forged and cast alloys at various temperature levels. Relative mechanical properties of the 53 alloys.

3b—Ferrous

3b-41. De l'Influence des Facteurs de Fabrication sur les Propriétés Magnétiques des Toles de Transformateurs. (Effect of Manufacturing Factors on the Magnetic Properties of Transformer Plates.) G. Delbart, R. Potaszkin, and M. Sage. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 193-209; *Sheet Metal Industries,* v. 25, March 1948, p. 503-508.

The properties of good transformer steels are reviewed and experimental conditions outlined. The greatest possible variations in compositions and methods of treatment, weights of ingots, number of heats, thicknesses of bars, and temperatures were investigated. Results are tabulated and illustrated by photomicrographs.

3b-42. Physical Characteristics of Steel for Tubular Products. A. B. Wilder. *A.S.T.M., Advance Print* AP12, 1947, 19 pages; discussion, p. 15-19.

Results of tests to determine some fundamental factors which influence toughness of steel and are related to steel-making practice. Grain-size determination; high-temperature tension tests; Charpy impact tests at various temperatures of material not cold worked; Izod impact tests of cold worked, tapered bars; and Charpy impact tests of cold worked tension specimens were used to evaluate properties of various types of steel.

3b-43. Service Properties of Manganese-Vanadium Plate Steels. F. F. Franklin. *Vancoram Review.* v. 5, no. 3, 1948, p. 8-9, 21.

3b-44. Vanadium Data Sheet. Vanadium Toolsteels—Part I. T. W. Merrill. *Vancoram Review,* v. 5, no. 3, 1948, p. 10-13.

3b-45. Fatigue Cracking of Retaining Ring Causes Turbine Accident. *Power*

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TESTING INSTRUMENTATION

vice is the Trentini surface tester (11-3, Feb 1947). A combination of mechanical and visual inspection methods is incorporated in a device to measure profile and surface roughness (11-8, Feb. 1947).

Instrumentation and Testing

A major portion of the cost of manufacturing a product can be attributed to time consumed and the allied costs of testing and inspection procedures. During the past year, major advances in the art of instrumentation have greatly increased the speed of testing and inspection. Existing mechanical gaging standards have been augmented by electronic devices and auxiliary mechanical equipment—sometimes to the point of complete automaticity. Other types of instrumentation (such as the use of phototubes in the General Electric Flicker Photometer) have converted qualitative tests to quantitative. Another such test using phototubes to make a qualitative test quantitative is the completely automatic magnaflux inspection unit. It can easily be seen that such instrumentation of existing nondestructive and destructive tests may greatly reduce time consumption and cost.

Interpretation of Test Data

To design a product that will perform efficiently the functions required of it, the designer must be able to predict failures which may occur in the service life of the product and design to avoid such failures if possible. The test engineer is entrusted with supplying the designer with the necessary criteria. In the case of physical tests, results are usually quantitative and, therefore, these criteria are easily defined. There are specific types of data, however, which the test engineer does not completely understand at present, and, therefore, either supplies qualitative data or relies upon empirical relations to provide the necessary information. In his search for a true measure of service performance, the test engineer often finds that existing test procedures do not provide the answer. Sachs, Ebert, and Brown (9-146, Jan. 1947) found that various steels and various heats of the same steel treated to yield identical properties in the conventional tensile tests still differed widely in performance. New findings (9-2, Feb. 1947) relate to the dependence of ultimate strength upon the duration of the tensile test and the rate of loading. Effects of the size and shape on tensile strength and the interpretation of test results are frequently noted (9-54, June 1947; 9-39, April 1947).

Since the inception of mechanical design, the engineer has been primarily concerned with the problem of strength from the static or instantaneous standpoint. True, he has been faced with problems of varying stress conditions but has solved them by empirical relationships. Only in the last quarter century has man approached problems such as vibration, fatigue, and creep analytically, and developed methods whereby failure due to these causes can be estimated and taken into consideration during the design of machinery and structures. An ever-increasing amount of research is being devoted to the investigation of new parameters influencing strength, such as time and temperature, and the critical examination of rate processes and the fundamental mechanisms involved in the failures. A. S. Norwick and E. S. Machlin of the National Advisory Committee for Aeronautics (9-24, March 1947) have developed an equation for steady-state creep rate in terms of specific dislocation mechanism; the generation of dislocations is considered to be a rate process. Theories of rate processes and of dislocation required for the development of creep equations are taken into consideration. These same authors (9-30, April 1947) again discuss the theory of these processes as applied to the stress-rupture of heat resisting alloys, and recommend that the method be investigated more thoroughly as a possible substitute for present empirical methods. Willim G. Lidman (9-115, Oct. 1947) discusses the determination of stress-rupture parameters for four heat resisting alloys, together with the theory of rate processes.

The test engineer, in his attempt to obtain quantitative data for the designer, and the inspector, in his attempt to correlate nondestructive test data so that rejection criteria may be estabished, often have erred on the side of conservatism. For example, consider the experiences that the Army had with some types of commercially built aircraft after the outbreak of the war. Many of these aircraft were loaded to as much as three times their designed gross weight and flown satisfactorily. Then there is the manufacturer of motor coaches who believed that the entire frame of the coaches could be removed without seriously impairing their strength. Proof load tests and strength tests of two coaches, one having a frame and one without, were conducted. The coaches were found to differ only slightly in their load-carrying capacity, but the frameless one's weight was greatly reduced. Attempts were made during the war to correlate properties as revealed by nondestructive X-ray tests to strength. Although many thousands of dollars worth of castings were rejected upon the basis of X-ray examination, actual strength tests performed on typical rejected castings showed them to be well within minimum strength requirements. These examples show that existing testing and inspection techniques are open to improvement and that this inadequacy serves as a stimulant for the development of new test methods and feet-on-the-ground interpretation.

Generation, v. 52, March 1948, p. 104, 106, 108.

Accident which caused failure of 2000-kw. turbo-generator in a textile-mill power plant. Failure was traced to operation of the machine under unbalanced-phase conditions.

3b-46. The Hardness of Steel. L. F. Keeley. *Machinery Lloyd* (Overseas Edition), v. 20, March 13, 1948, p. 68-70.

Various test methods and the effects of different alloying elements on hardenability.

3b-47. Rate of Propagation of Fatigue Cracks in 12-Inch by ¾-Inch Steel Plates With Severe Geometrical Stress-Raisers. Wilbur M. Wilson and James L. Burke. *University of Illinois, Engineering Experiment Station, Bulletin Series* No. 371, (v. 45, no. 10), Sept. 29, 1947, 16 pages.

Test results. Description of test procedure and apparatus.

3b-48. Influence of Columbium on the Properties of Low-Tungsten, High Speed Steel. (In Russian.) N. T. Gudtsov and L. D. Mashtakova. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1629-1637.

A series of steels, compositions of which are tabulated, were investigated. They contained 2.6 to 3.2% W 0 to 3.0% Cb, and 8 to 9% Cr. Addition of Cb decreased the cutting properties and workability to a considerable extent.

3b-49. Phosphorus in Cast Iron. E. Piwowarsky. *Pig Iron Rough Notes*, Winter 1948, p. 2-9. Translated from the German.

Effects of different percentages of phosphorus on structure and mechanical properties. (To be continued.)

3b-50. New Steels. J. G. Morrow. *Canadian Metals & Metallurgical Industries*, v. 11, March 1948, p. 14-15, 34.

A general survey.

3b-51. Modern Engineering Cast Iron. Donald J. Reese. *Metal Progress*, v. 53, April 1948, p. 539-544.

Compositions and structures of the various cast irons, their production, engineering properties, and applications.

3b-52. Which Wrought Stainless Steel? Part II—Fitting the Material to the Part. Stanley P. Watkins and Roland J. Berkol. *Machine Design*, v. 20, April 1948, p. 174-179.

General characteristics and applications of the various types.

3b-53. Brittle Fracture in Mild-Steel Plates—Part II. (Continued.) *Engineering*, v. 165, Feb. 27, 1948, p. 208-210; March 5, 1948, p. 222-223.

Report on conference held at Cambridge, England, Oct. 26, 1945. This installment begins "Brittle Fracture of American Ship Plates", by W. Barr. Four sets of plates from welded ships which had failed were shipped to England for investigation. Results of thorough investigation. One factor noted was lower Mn content than is common British practice. (To be continued.) See Item 3b-27.

3c—Nonferrous

3c-14. Fatigue Characteristics of Some Copper Alloys. H. L. Burghoff and A. I. Blank. *A.S.T.M., Advance Print* AP1, 1947, 18 pages.

Fatigue characteristics of Cu and several Cu alloys, available commercially in the form of rod, as determined in rotating-beam fatigue tests. Fatigue properties for more than one temper.

3c-15. The Creep Characteristics of Copper and Some Copper Alloys at 300, 400, and 500° F. H. L. Burghoff and A. I. Blank. *A.S.T.M., Advance Print* AP2, 1947, 30 pages; discussion, p. 30.

Information obtained in a continuing program of creep testing of wrought Cu alloys. Creep data including total creep, creep rates, and relative creep strengths, are shown for four types of Cu and several Cu alloys in annealed and hard-drawn tempers. Tensile properties and notations on microstructure of test materials before and after creep testing are given.

3c-16. Magnesium-Cerium-Zirconium Alloys; Properties at Elevated Temperatures. A. J. Murphy and R. J. M. Payne. Cerium Metals Corp., New York, 1947, 26 pages. Reprinted from *Journal of the Institute of Metals*, v. 73, Nov. 1946, p. 105-127.

Previously abstracted. See item 3-5, R.M.L., v. 4, 1947.

3c-17. Supermalloy. *Bell Laboratories Record*, v. 26, March 1948, p. 111-113.

Development of alloy which has an initial permeability 500 times that of iron.

3c-18. Incipient Superconductivity in Titanium. Robert T. Webber and J. M. Reynolds. *Physical Review*, 2nd Series, v. 73, March 15, 1948, p. 640.

Measurements on Ti wire made at the Bureau of Standards by reduction of the chloride with Mg at 1000° C. in argon. Resistances were determined from 1.1 to 4.23° K. in presence and absence of magnetic fields of intensities up to 1200 gausses. Incipient superconductivity observed is believed due to an impurity, but possibility of actual superconductivity below 1.1° K. is indicated.

3c-19. Heat Capacity of Low-Melting Metals in the Solid and Molten States. (In Russian.) G. M. Bartenev. *Zhurnal Tekhnickeskoi Fiziki* (Journal of Technical Physics), v. 17, Nov. 1947, p. 1321-1324.

Results of a determination from heating and cooling curves of the heat capacity of Pb and Sn in both states and in the melting-point regions. The phenomenon of anomalous heat capacity of Sn at 166° C.

3c-20. Heat of Fusion of Tin, Lead, and Their Eutectics. (In Russian.) G. M. Bartenev. *Zhurnal Tekhnickeskoi Fiziki* (Journal of Technical Physics), v. 17, Nov. 1947, p. 1325-1330.

A method for determination of heat of fusion from coefficient of heat exchange and its application to the above. Results in connection with establishment of the structure of liquid eutectics.

3c-21. The Variation With Magnetization of Young's Modulus for Cobalt. R. Street. *Proceedings of the Physical Society*, v. 60, March 1948, p. 236-243; discussion, p. 243.

Variation for specimens of annealed and unannealed cobalt was investigated, for field intensities up to about 700 oersteds, by the method of magneto-strictive oscillation. The decrement of longitudinal oscillation in cobalt rods was also measured, and found to be of the order of 10^{-3}. 15 ref.

3d—Light Metals

3d-16. Aluminum Alloys. G. Fitzgerald-Lee. *Aluminium and the Non-Ferrous Review*, v. 12, Oct.-Dec. 1947, p. 73-74, 76, 78, 80.

Reviews the various types made in Britain. Effects of each alloying metal. Table gives compositions and properties of the main commercial alloys.

3d-17. Tensile, Fatigue, and Creep Properties of Forged Aluminum Alloys at Temperatures Up to 800° F. L. R. Jackson, H. C. Cross, and J. M. Berry. *National Advisory Committee for Aeronautics, Technical Note No.* 1469, March 1948, 48 pages.

Data on properties of forged aluminum alloys XB 18 S, 18 S, 24 S, and 32 S, which are pertinent to their use between 70 and 800° F. Included are data taken from published sources, unpublished material made available through the courtesy of the Aluminum Co. of America and the National Bureau of Standards, and original data, obtained at Battelle Memorial Institute, which extend this previous information. Application to design of aircraft engines.

3d-18. The Influence of Chemical Composition and Quality of Raw Materials on the Physical Properties of Silumin Gamma. Vlad. Zednik. *Metallurgia*, v. 37, Feb. 1948, p. 195-200; March 1948, p. 253-258.

For casting purposes, an Al-base alloy with additions of Si and Mg proved to be one of the best from the point of view of good all-round properties. This alloy, known commercially as silumin (Alpax) gamma, derives its properties from the binary Al-Si eutectic alloy modified with sodium. Details of the development of, and experiences with, this alloy at the Skoda works in Czechoslovakia. Second part is largely devoted to use of Co and Mn as compensators for the undesired effects of small percentages of Fe and Ti. Structures of various compositions and those resulting from production variations.

3d-19. Typical Mechanical Properties of Aluminum Sheet and Plate. *Production Engineering & Management*, v. 21, April 1948, p. 71.

A table.

3d-20. Properties and Applications of Aluminum Casting Alloys. Floyd A. Lewis. *Electrical Manufacturing*, v. 41, April 1948, p. 112-117, 149-150.

For additional annotations indexed in other sections, see:

2c-23; 4c-18; 6a-30; 8-63-87-101; 11-80-81; 23b-21; 24b-44-45; 27a-47-57; 27b-17-19; 27c-7-9; 27d-5.

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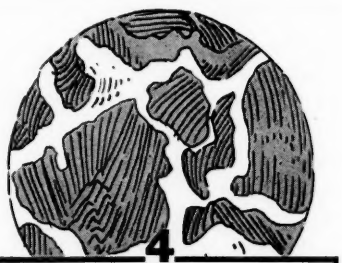


CONSTITUTION and STRUCTURE

4a—General

4a-16. History of Crystal Growth Revealed by Fractography. C. A. Zapffe, F. K. Landgraf, Jr., and C. O. Worden, Jr. *Science*, v. 107, March 26, 1948, p. 320-321.

Development of fractographic technique at Battelle Memorial Institute,

(Turn to page 12)

Tools for Testing

A Review of Testing and Inspection Equipment for the Metal Industries Introduced During the Past 12 Months

THE RAMIFICATIONS of testing and inspection which interest the metallurgist extend in a dozen or more different directions. The standardized mechanical and physical tests are his indispensable tools; specialized testing equipment points the way toward the design and refinement of intricate parts and products; while the ingenious inventions of the war and postwar years in the field of nondestructive and inspection testing have immeasurably furthered large-scale high-speed production processes.

The following article describes, largely in the manufacturers' words, a year's developments in the testing equipment that is most pertinent to the problems of the metallurgist, metallurgical designer and metalworking engineer. It includes new equipment and accessories for mechanical testing, some of the more relevant pieces of laboratory equipment, inspection devices for discovering defects, various gages and comparators, and a smattering of shop inspection equipment. The step to instruments that control as well as test is a small one, but they are largely excluded from this review since they were the subject of a similar article in last December's issue.

The descriptions that follow are necessarily brief but more complete details are readily available from the manufacturers. Each of the descriptions is numbered and a coupon is provided on page 23. To secure further information on one or more products, it is only necessary to circle the corresponding numbers on the coupon and return it to *Metals Review*.

Mechanical Testing

While hydraulic universal testing machines in the million-pound class are no longer startling, a 2,000,000-lb. machine, built recently by Baldwin Locomotive Works **(405)** for University of Washington is still news. New construction principles are embodied in this machine that will give it 300 to 400% greater rigidity than similar machines of earlier design. It is to be used for tension and compression testing as well as transverse testing. It will take specimens up to 10 ft. wide, 20 ft. high, and (for transverse testing) 80 ft. long. Special flex-plate construction to tie the sensitive yoke to the transverse rigid beam, adjustable triangular guides, and steel columns that flare from a point about one-third the way from the top to the base of the machine are the new design features that give it greater accuracy and rigidity.

A new type of Baldwin Tate-Emery testing machine, designed primarily for precision testing of nonferrous metals, plastics, rubber, and similar materials is of 5000 lb. maximum capacity **(406)**. Unlike the larger hydraulic machines, this model uses a mechanical screw loading system. Speed of loading is steplessly variable from 0.05 to 20 in. per min., and can be held constant within ± 2%.

Baldwin Tate-Emery 5000-Lb. Universal Testing Machine

In the weighing system the Emery capsule, which is used in most Baldwin testing machines, is replaced by a 100:1 mechanical compound lever using flex plates instead of the conventional knife edges at the load points and fulcrums. The specimen is pulled, compressed or flexed at the short lever end. The long end of the lever operates the force balance mechanism of the indicating system.

Simplicity, speed and accuracy are furthered by several design innovations in the new PH-60 (60,000 lb. capacity) universal hydraulic testing machine introduced by Riehle Testing Machines Division of American Machine and Metals, Inc., **(407)**. It is easy to calibrate simply by sliding movable knife edges. Five scale ranges are controlled by a selector knob, rather than by manipulating loose balancing weights. A simplified design of loading frame provides more space for specimens, and a built-in recorder can be furnished.

Another machine that features fast and simple operation is made by Detroit Testing Machine Co. for testing spot welds, strip and wire **(408)**. Hydraulically operated, it is available in 10,000 and 20,000-lb. capacities. Movement of the ram is controlled by a graduated dial and spoked knob on the front of the machine. Various speeds are obtained by turning the dial to the right. A small movement to the left returns the ram to the down position. The grips are open-sided for easy insertion of the specimen.

Among the smaller tensile testing machines is the Swiss-made Amsler, for which Adolph I. Buehler is general agent in this country **(409)**. The Amsler horizontal machine has metallurgical applications in the testing of fine wire. It has a pendulum load weighing system, five load ranges, and automatic load-extension diagram recorder. Stress is applied by means of a screw which moves the pulling specimen holder away from the fixed specimen holder that is attached to the weighing, indicating and recording mechanism. The tensile load applied is balanced by the deviation of the pendulum from the vertical position.

W. C. Dillon & Co. has improved its Hercules Model L **(410)** by lengthening the uprights to give a 13-in. spread between grips so that longer specimens can be handled. A keyless power screw makes for smooth operation. Grips are interchangeable to handle tensile, transverse, compression or shear tests. The Model L is available in seven ranges from 25 to 10,000 lb.

Dillion also has a new 100-lb.

(*Turn to page* 13)

For Bulletins and Further Information, Use Reader Service Coupon on Page 23

Rustless Iron and Steel Corp., and in the laboratory of the senior author for Office of Naval Research. In the latter laboratory, the technique has been extended to elemental metals, alloys, and certain intercrystalline phenomena such as Neumann bands, as well as dissociation phenomena within inclusions. Fractographs of ammonium dihydrogen phosphate, molybdenum, chromium ferrite, and zeta silicon ferrite reveal much of the history of crystal growth. Each metal and alloy composition seems to have a highly characteristic pattern which can be used for identification and whose principal features are unalterable.

4a-17. An Experimental and Theoretical Investigation of Diffusion in a Two-Phase Alloy. Vera Daniel. *Proceedings of the Royal Society*, (Series A), v. 192, March 18, 1948, p. 575-592.

Results of an investigation of diffusion in the solid state. Previous experimental work has been confined to the case in which the free energy of a mixture is a minimum for the single-phase state, and diffusion decreases local differences of concentration. However, it is possible for the free energy to be a minimum for the two-phase state; diffusion may then increase differences of concentration. Becker has proposed a simple theoretical treatment of these two types of diffusion in a binary alloy. An experimental test of this theory, using the unusual properties of the alloy Cu_4FeNi_3 show results in fair agreement with conclusions drawn from Becker's theory. It was found that Fick's equation can, within the limits of error, be applied in all cases.

4b—Ferrous

4b-22. A Study of the Transition From Shear to Cleavage Fracture in Mild Steel. Harmer E. Davis, Earl R. Parker, and Alexander Boodberg. *A.S.T.M., Advance Print* AP3, 1947, 19 pages; discussion, p. 18-19.

Results of tests on unnotched cylindrical tension bars, 3-in. wide flat bars with saw-cut notches in each edge, and 12-in. wide plates with a central notch at the midsection. The mechanism of fracture in relation to variation in shear and cleavage strength with temperature and to the state of stress as induced by notching or deformation.

4b-23. Diffusion of Carbon in Austenite. (In Russian.) M. E. Blanter. *Zhurnal Tekhnickeskoi Fiziki* (Journal of Technical Physics), v. 17, Nov. 1947, p. 1331-1340.

A new method for determination of the diffusion constant. A formula for the above diffusion as a function of carbon concentration and temperature is derived from a study of experimental data. This formula has a maximum error of 7.5 to 8.0%. 10 ref.

4b-24. Heterogeneity of Steel Ingots and Their Crystallization. (In Russian.) V. A. Davidenkov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1683-1703.

Factors which indicate directly or indirectly the presence of heterogeneity were investigated on several ingots produced by different methods. Relationships between content, number, and dimensions of inclusions; mechanical properties; toughness; and microstructures were established. Conclusions concerning the mechanism of crystallization. 39 ref.

4b-25. Final Progress Report; Fundamental Investigation of Graphitization of Piping. L. E. Hankison, T. E. Purcell, and Alex D. Bailey. *Edison Electric Institute Bulletin*, v. 16, Feb. 1948, p. 43-44; also "Issues Final Report on Study of Graphitization of Piping" (same authors). *Heating, Piping & Air Conditioning*, v. 20, Apr. 1948, p. 76-77.

Results obtained at Battelle Memorial Institute since March 1947, involving: continued tests at 1125° F. of previously tested materials which had indicated good resistance to graphitization; and further effort to evaluate the influence of elastic stress and plastic deformation on graphite formation. Alloys investigated were as follows; plain-carbon, low-Al steel; C-Mo, low-Al, steel G-18; C-Mo, low-Al, Steel G-19; C-Mo, Si-deoxidized steel; C-Mo, Ti-deoxidized, ½-2½%-Cr steel; ½-1%-Mo steel; and Mo-V steel.

4b-26. The Formation of Sigma Phase in Duplex Chromium-Nickel-Molybdenum Corrosion-Resisting Steels. H. W. Kirkby and J. I. Morley. *Journal of the Iron and Steel Institute*, v. 158, March 1948, p. 283-294.

Results of an investigation of sigma formation in two 18-8 steels, containing Mo and Ti in the one case and Mo and Cb in the other. Time-temperature studies showed that sigma forms very rapidly at 850° C. in both these alloys with accompanying increase in hardness, loss of magnetism, and decrease in ductility. They also suggest that the formation of sigma causes alloy depletion locally, which may have an effect on corrosion resistance in certain circumstances. A detailed study was made in regard to changes in microstructure accompanying sigma formation, using etching reagents designed to distinguish sigma from ferrite, austenite, and carbide.

4b-27. The Production of Nodular Graphite Structures in Cast Iron. H. Morrogh and W. J. Williams. *Journal of the Iron and Steel Institute*, v. 158, March 1948, p. 306-322.

Additions of Ce resulted in nodular structures in hypereutectic alloys even with very low Ni contents. Attempts to produce nodular structures by adding Ce to low-sulphur, hypo-eutectic, cast irons were only partially successful, but when hypereutectic irons were treated, structures consisting of hypereutectic spherulites and quasi-flake graphite were obtained. The influence of sulphur upon the Ce treatment and general composition requirements for the production of nodular structures in the as-cast state. The mechanism of solidification of these irons. When the number of hypereutectic nodules is increased artificially, no quasi-flake graphite forms. A process for accomplishing this involving addition of a graphitizing inoculant after the Ce addition. Mechanical properties are very good. Ce may be added in the form of "mischmetall". 20 ref.

4b-28. The Occurrence and Some Effects of Sigma Phase in a Molybdenum-Bearing Chromium-Nickel Austenitic Steel. L. Smith and K. W. J. Bowen. *Journal of the Iron and Steel Institute*, v. 158, March 1948, p. 295-305.

The existence of a hard, brittle, nonmagnetic phase, analogous to the compound FeCr, and called the sigma phase, was confirmed in 18-8-3-1 Cr-Ni-Mo-Ti steel. It is shown that when this steel is reheated in the range 500 to 970° C., the sigma phase is formed from the ferrite. The formation of the sigma phase and its effect on mechanical properties and corrosion resistance. The investigation was aided by development and use of an instrument, the "Ferrometer", which enables changes in ferromagnetism in a steel to be followed and measured. X-ray crystallography and microscopic examination were used to survey the microstructure from 500 to 1150° C. In addition, the mode of formation of sigma from ferrite at 850° C. was explored.

4c—Nonferrous

4c-18. The Technology of Copper-Lead Alloys. R. W. K. Honeycombe. *Section of Tribophysics, Council for Scientific & Industrial Research, Commonwealth of Australia, Physical Metallurgy Report* No. 6, Serial No. A.158. Oct. 20, 1947, 18 pages.

A discussion of those alloys of Cu containing between 10 and 40% Pb with or without small percentages of other elements such as Sn, Ag, Ni, and P. The majority of the Cu-Pb alloys used in heavy-duty bearings fall into this category; however, such alloys find many other applications. The effects of minor alloying elements; effects of temperature on structure; use of deoxidants; casting of Cu-Pb alloys; frictional and wear properties; and applications.

4c-19. The Ratio of Valence Electrons to Atoms in Metals and Intermetallic Compounds. Linus Pauling and Fred J. Ewing. *Reviews of Modern Physics*, v. 20, Jan. 1948, p. 112-122.

Numbers of valence electrons assigned to γ—alloys, β—manganese and alloys with similar structure, and α—manganese by a new system of metallic valences agree closely with electron numbers calculated for complete filling of important Brillouin polyhedra for these structures.

4c-20. Viscous Slip Along Grain Boundaries and Diffusion of Zinc in Alpha Brass. T'ing-Sui Ke. *Journal of Applied Physics*, v. 19, March 1948, p. 285-290.

The viscous behavior of the grain boundaries in 70-30 alpha brass has been demonstrated by anelastic measurements. The grain boundaries cannot sustain permanently a shear stress and have a coefficient of viscosity decreasing with an increase of temperature. Using the same specimen, activation energy associated with stress-induced preferential orientation of pairs of Zn atoms in alpha brass was determined and found to be identical, within experimental error, to activation energy associated with grain-boundary slip in alpha brass. This indicates that grain boundary slip is a diffusion process and that the diffusion mechanism is similar to volume diffusion. 14 ref.

4c-21. An Electron Compound in Alloys of the Transition Metals. A. H. Sully and T. J. Heal. *Research*, v. 1, March 1948, p. 288.

During preliminary investigation of the constitution of Cr-Co alloys, it was noted that some alloys in the range 25 to 50% Cr, under certain conditions of heat treatment, contain a phase isomorphous with the sigma phase which occurs in the Fe-Cr system. Wever and Haschimoto have previously assigned a range of homogeneity from 40 to 45% Co at room temperature to a delta phase, the diffraction pattern of which also appears to be isomorphous with the sigma phase.

(Turn to page 14)

TOOLS FOR TESTING

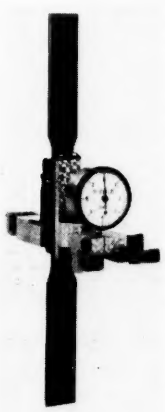
strength tester **(411)** that is compact, hand-held, accurate, and sells for under $50. It will test tensile specimens 1 3/4 in. wide x 1/8 in. thick, wire specimens up to 1/8 in. diameter, and in compression will handle steel, aluminum and brass.

Electro-hydraulic tensile strength testers that range in capacity from 1 to 1100 lb. are described in detail in a new 15-page booklet by Thwing-Albert Instrument Co. **(412)**. Various attachments and accessories for a wide range of applications are included.

Tensile Testing Accessories

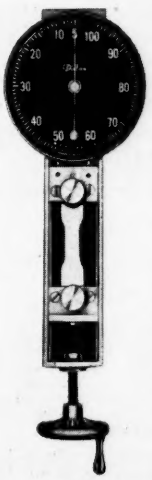
Distinguishing feature of a new strain rate pacer exhibited by Baldwin Locomotive Works at the 1947 National Metal Congress **(414)** is that it permits the testing machine operator to maintain a constant rate of displacement between specimen gage points, rather than a constant rate of motion of the crosshead. It operates in conjunction with Baldwin autographic stress-strain recorders and extensometers. The strain pacer equipment consists of a cabinet which contains the pacing disk and pointer, and a transmitter unit mounted in the stress-strain recorder. Rotation of the pointer of the strain pacer is proportional to the value of strain shown on the recorder drum.

Another new Baldwin accessory is the Tate-Emery air cell **(415)**—an independent load-weighing device made to insert in the grip slot of a testing machine. It extends the precision range of the testing machine downward to a very small value of load. It has its own compression head for compression testing, and a threaded extension to which grips can be attached when it is to be used for tension testing.



Riehle Clamp-O-Matic Dial Extensometer Attached to Flat Specimen

The Riehle Clamp - O - Matic dial extensometer **(416)** clamps directly onto the specimen under test and automatically maintains its grip. It is attached to the specimen by pressing a lever which operates the back contact. An adjusting screw applies the correct spring pressure on the contact for the range of diameter or thickness of the specimen being tested. It can be used with rounds, flats, sheets or wires.



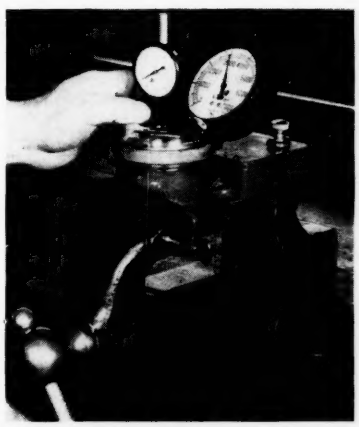
Dillon 1000-Lb. Strength Tester

A laboratory press of 20 tons capacity is available from Hydraulic Press Mfg. Co. **(417)** with attachments for tension and compression testing as optional equipment. Maximum opening between the 8 x 9-in. pressing surfaces is 14 in. The press bed is stationary, and the top platen movable to the work.

A timesaver for the testing engineer is a tensile strength computor (slide-rule type) offered by W. C. Dillon & Co., Inc. **(418)**. Knowing any two of three factors—psi., size of specimen, or load—the third factor can be instantly ascertained.

Ductility and Stiffness Testers

A new, portable cup tester for sheet metal supplements Detroit Testing Machine Co.'s line of larger motor-driven machines **(419)**. The unit weighs only 23 lb. and is used in an ordinary machinist's vice, although it incorporates the same hydraulic clamping principle used in the larger machines.



Detroit Testing Machine Co.'s Portable Cup Tester for Sheet

A specimen approximately 3½ in. in diameter is placed under the knurled cap, which is then screwed down lightly and the vise closed. The vise jaw forces a small plunger into the body of the machine, which in turn actuates the ram. Since the vise pressure is stepped up approximately 3 to 1, the machine will test up to 16-gage mild steel with little effort. A gage indicates depth of draw.

A motor-driven stiffness tester developed by W. and L. E. Gurley **(420)** is applicable to thin, flexible sheets of light metal and foil. A balanced pointer that moves parallel to a sine scale mounted on the base is loaded below the center with weights of 5 to 200 g., fastened 1 to 4 in. from the pivots. The arm carrying the sample is moved by a small-geared synchronous motor controlled by a reversing switch on the base. Samples are cut to a standard width and length and clamped so that the free end overlaps the top of the pointer by ¼ in. The pointer is automatically released and the greatest reading of the pointer against the sine scale is averaged in both directions.

Gurley Stiffness Tester

A new catalog on stiffness testers has been issued by Tinius Olsen Testing Machine Co. **(421)**. Applications cited are for checking watch springs, hypodermic needle tubing, dental and precious metals, thin sheet, strip and wire. The machines are available in 1, 6 and 50 in.-lb. moment capacities.

A simple and direct method for testing the quality of high speed steel in cutting edges of tools after heat treatment is provided by a new toughness tester made by the Hall

(Turn to page 15)

The isomorphism of these phases is said to be of importaince for the development of alloys for use at high temperatures.

4c-22. The Catalytic Reaction of Hydrogen and Oxygen on Plane Faces of a Single Crystal of Copper. Henry Leidheiser, Jr., and Allan T. Gwathmey. *Journal of the American Chemical Society*, v. 70, March 1948, p. 1200-1206.

Single crystals in the form of spheres exposing all possible faces and in the form of slices parallel to a particular face were studied. The crystals were mechanically and electrolytically polished and annealed in hydrogen. With oxygen concentrations of 1 to 20% at 400° C., regular rearrangements were found to take place in the surface of the metal, exposing certain facets on some faces, roughening others without the development of particular planes, while other faces remained quite smooth and were apparently undisturbed.

4c-23. The Selective Deposition of Carbon on the (111) Face of a Nickel Crystal in the Catalytic Decomposition of Carbon Monoxide. Henry Leidheiser, Jr., and Allan T. Gwathmey. *Journal of the American Chemical Society*, v. 70, March 1948, p. 1206.

Results reported are an example of a catalytic process which does not lead to visible rearrangement of the surface initially and which proceeds at a rate dependent on crystal face.

4c-24. Solidification Mechanism of Tin Bronzes. Clyde L. Frear. *Foundry*, v. 76, April 1948, p. 68-71, 124, 126.

Most of the discussion deals with gun metal conforming to Navy department specification 46-M-6, but applies equally well to the 90-10 or the 88-10-2 alloy. Since the type of defect which is the chief cause of leakage in bronze castings is the one known as interdendritic shrinkage, intergranular shrinkage, shrinkage porosity, overall porosity, microshrinkage, or microporosity, the article is limited to this phenomenon, its causes, and methods for combating difficulties caused by its presence. (To be concluded.)

4c-25. Liquidus-Solidus Points of the Manganese-Nickel System. Jack M. Paul and G. V. Beard. *Journal of Physical & Colloid Chemistry*, v. 52, April 1948, p. 750-753.

The liquidus-solidus points of the above alloys from 35% Mn-65% Ni to 80% Mn-20% Ni were determined.

For additional annotations indexed in other sections, see:

2b-57; 3c-15; 3d-18; 5b-9; 11-62-65-69; 18b-50; 19a-74; 27a-58; 27b-17; 27c-7.

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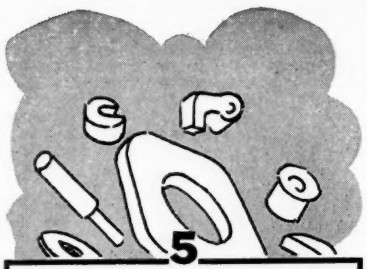

5a—General

5a-14. Powder Metallurgy Has Some Limitations. Thomas J. Hughel and Stuart T. Ross. *Industry and Power*, v. 54, April 1948, p. 89-90.

Powder metallurgy is not a "cure all". The method has made possible products that cannot be obtained in the form desired by any other technique. Inherent physical limitations of the process; lack of fundamental knowledge; cost factors.

5a-15. Physical Processes Involved in Sintering. D. H. Bangham. *Journal of the Society of Glass Technology*, v. 31, Oct.-Dec. 1947, p. 264-266.

Fundamental principles. Applicable to both metals and nonmetals.

5a-16. Powder Metallurgy as a Research Tool. F. N. Rhines. *Powder Metallurgy Bulletin*, v. 3, March 1948, p. 28-38.

Special advantages powder metallurgy has for the research metallurgist interested in studies of fundamental properties of metals and alloys.

5a-17. Powder Metallurgy—Its Current Problems—Its Prospects. Robert L. Ziegfeld. *Iron Age*, v. 161, April 8, 1948, p. 72-74.

Increased usage of powder metallurgy and wider dissemination of information and statistics and standardization of powder specifications and testing methods are essential to optimum development in the future. The directions research is taking.

5a-18. Powder Metallurgy as Applied to Permanent Magnets. A. E. Franks. *Iron Age*, v. 161, April 8, 1948, p. 82-85.

Procedures for developing the necessary properties including precautions that must be observed in order to obtain optimum results. Also indicates that several new magnetic materials, now in the development stage, possess many desirable characteristics that promise further broadening of the field of powder metallurgy in the magnet industry.

5a-19. Powder Metallurgy; Low Cost Equipment for Volume Production. Robert Talmage. *Iron Age*, v. 161, April 8, 1948, p. 86-91.

A potential method for combating rising material and labor costs is in application of powder-metallurgy techniques in large-scale production of small parts. Various components that can be accurately and rapidly manufactured with relatively inexpensive equipment. Costs of making a typical part in the screw machine and from metal powder.

5b—Ferrous

5b-9. Métallurgie des Poudres Métalliques: Aciers au Nickel. (Metallurgy of Powdered Metals: Nickel Steels). Laurence Delisle and Walter V. Knopp. *Revue de Métallurgie*, v. 44, July-Aug. 1947, p. 245-255.

Preparation of nickel steels from a mixture of metal powders and graphite by diffusion in the solid phase, without melting. At 1325° a steel containing 3.5% Ni, 0.23% C, 0.75% Mn, and 0.20% Si was prepared and had a tensile strength of 99.9 kg. per sq. mm. and 3% elongation after quenching and tempering. Diffusion was not complete in any case, and powdered alloys were substituted for pure metals to obtain a homogeneous product. These nickel steels have Ni-rich martensitic crystals in a Ni-poor pearlite matrix. Further research is contemplated.

For additional annotations indexed in other sections, see:

2b-71; 2c-25; 6a-67.

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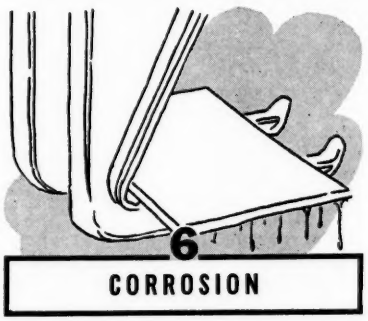

6a—General

6a-30. Metallurgical Methods for Combating Corrosion and Abrasion in the Petroleum Industry. B. B. Morton. *Journal of the Institute of Petroleum*, v. 34, Jan. 1948, p. 1-59; discussion, p. 59-68.

Steps that have been taken within the petroleum industry of the U. S. to counteract the above and recent metallurgical developments within the industry. Emphasis is on use of a wide variety of nickel alloys although some others are mentioned.

6a-31. A Study of the Kinetics of Bearing Corrosion and Oil Oxidation: Correlation of Various Test Methods. Hugh R. Lehman, and L. Kermit Herndon. *Engineering Experiment Station News*, (Ohio State University), v. 20, Feb. 1948, p. 45-52.

A method of graphical analysis for the corrosion curves exhibited by the MacCoull Bearing Corrosion Tester. Application to such widely differing test methods as the Indiana stirring oxidation test and the oxygen-absorption method of Dornte is demonstrated. This indicates existence of a method of correlating the extensive bearing corrosion and oil oxidation data in the literature. 12 ref.

6a-32. Fretting Corrosion. *Lubrication*, v. 34, March 1948, p. 25-36.

A particular type of corrosion found on the contact areas of loaded metal surfaces subject to oscillatory or vibrating motion. The phenomenon is also known as "false brinelling" and as "friction oxidation". The nature of the process; the effects of load, surface finish, and materials; some suggested

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TOOLS FOR TESTING

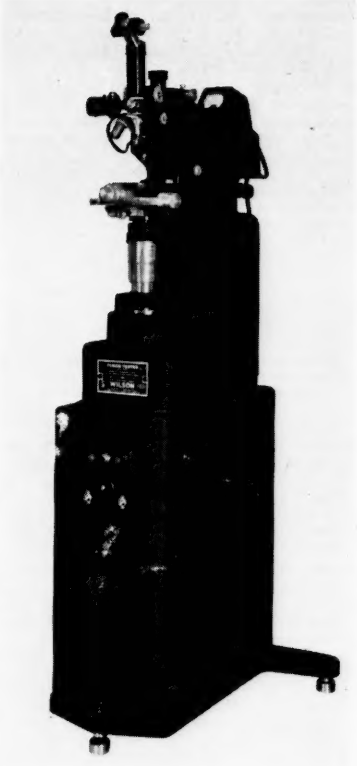
Steel City Brinell Machine

Planetary Co. **(422)**. The test piece is placed on the anvil beneath the stylus punch. Pressure on the punch is slowly increased until the tool edge breaks. The gage reading at rupture and a visual inspection afterward are an index of the toughness of the material at the service edge. A clean break with displacement of a small volume of metal indicates a satisfactory toolsteel, properly heat treated. Spalling indicates a cutting edge with poor wearing qualities.

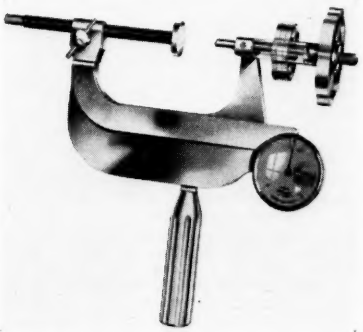
Hardness Testers

A motor-driven, hydraulically operated Brinell testing machine capable of checking up to 800 pieces per hr. is announced by Steel City Testing Machines, Inc. **(423)**. Parts varying in diameter and thickness as much as 3/4 in. may be tested without moving the elevating screw. The machine is so constructed that it is impossible for the operator to remove the specimen before the full load has been applied to the penetrator. It is equipped with a comparator indicator so that the Brinell microscope is not necessary on production testing.

Wilson Mechanical Instrument Co. **(424)** has announced a new heavy-load Model LR Tukon tester that applies loads of 25 to 50,000 g. It can be used for testing with either the Knoop or 136° diamond pyramid indenter (Vickers type). Features include a fast elevating screw for adjustment to specimen thickness, and



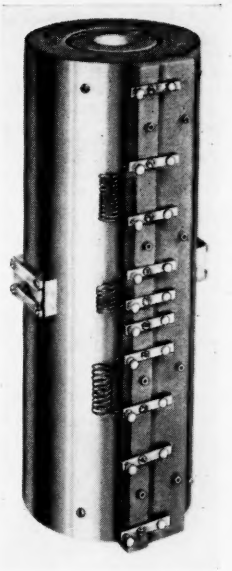
Heavy-Load Tukon Tester



Ames Portable Hardness Tester

a meter to show when the load is being applied to the indenter and to indicate when the electronic tube is in operating condition and when the test cycle has been completed. Loads of 10,000 g. are furnished as standard equipment. Loads from 10 to 50 kg. are accessories.

Ames Precision Machine Works **(425)** now has a 4-in. capacity portable hardness tester similar to the 1-in. model announced about a year ago. It weighs slightly over 3 lb. and reads directly in the Rockwell hardness scale. A diamond penetrator is used for testing hardened steel and ball penetrators for soft materials. Pressure is applied by turning a handwheel and is read on a dial indicator. Rockwell readings are taken from a graduated barrel dial, which has a lucite magnifier for easy reading.



Marshall High-Temperature Furnace

High-Temperature Testing

Specific information about the properties of heat resistant alloys is essential to guide design engineers in specifying the proper materials for rocket and jet engines, for steam turbines, furnace construction, oil refining, gas turbines and turbo superchargers, and for chemical processing equipment. Much emphasis has consequently been placed during the past ten years on the refinement of equipment and experimental procedure for high-temperature testing. A recent result of development in this field is the Marshall furnace and control panel built by L. H. Marshall Co. **(426)**.

The furnace is used to make 1000-hr. tests in the range of 1200 to 2200° F., with a choice of applied stress covering a 50 to 50,000-psi. range in increments of 50 psi. Mechanical refinements in the furnace simplify calculation. The heating element is a resistance wire wound in fixed position on an alundum tube. Maximum temperature gradient over a 4-in. gage length is ± 1° F. Since the furnace is four times the gage length of the specimen, sharp temperature differentials at the ends of the test

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remedies, including use of lubricants.

6a-33. Corrosion Potential. *Industrial and Engineering Chemistry,* v. 40, April 1948, p. 16A, 22A.

Polarographic method for obtaining corrosion data quickly which is being developed at University of Oregon under sponsorship of Office of Naval Research. It is stated that it may soon be unnecessary to expose metal panels in sea water for months in order to determine corrosion characteristics and that sufficient corrosion data may be obtained in one hour to yield conclusions comparable to those based on seashore test-rack experiments.

6a-34. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 40, April 1948, p. 103A-104A.

Corrosion of steel, cast iron, and lead by sulphuric acid and the choice of materials for pipe lines.

6a-35. Chemical Research and Corrosion Control: Some Recent Contributions of a Corrosion Research Group. W. H. J. Vernon. *Corrosion,* v. 4, April 1948, p. 141-148. Condensed from *Journal of the Society of Chemical Industry,* v. 66, May 1947, p. 137-142.

Previously abstracted. See item 6-241, R.M.L., v. 4, 1947.

6a-36. Mechanism of Oxidation and Tarnishing. Ulick R. Evans. *Corrosion,* v. 4, April 1948, p. 149-171.

Previously abstracted from an Electrochemical Society Preprint. See item 6-49, R.M.L., v. 4, 1947.

6a-37. Fretting Corrosion — How to Eliminate It. E. V. Albert. *Steel,* v. 122, April 5, 1948, p. 72-76, 96, 98.

A progress report on investigations reported up to the present time on fretting corrosion, also known as false brinelling or friction oxidation—the corrosion occurring on contact areas of loaded metal surfaces subject to oscillatory or vibrating motion.

6a-38. Irreversible Electrode Potentials of Metals and Their Solid Solutions. Part I. Irreversible Electrode Potentials of Metals. Part II. Electrode Potentials of Solid Solutions. G. W. Akimov and G. B. Clark. *Transactions of the Faraday Society,* v. 43, Nov.-Dec. 1947, p. 679-697.

Method which was developed for measurement of electrode potentials of metals and alloys during surface rubbing of the immersed specimens. Comparison of potentials obtained with and without rubbing permits conclusions to be made about the tendency of the metals to form protective films. The potentials of 22 metals were measured in 0.1 *N* HNO_3, 0.1 *N* NaOH, and 3% NaCl solutions. Some suggestions about the nature of irreversible potentials of pure metals and solid solutions. In Part II, electrode potentials of the following systems were measured in the same solutions as above: Al with Cu, Zn, Mg, Li, Si; Zn with Al, Cu, Ag, Au; Mg with Al, Zn, Cd, Tl, Sn, Pb; Cu with Al, Zn, Ni, Mn, Ag, Be, Cd, Sn. Results are classified into groups according to the relationship between the potential of the solid solution and its composition. No relationship was found between the potential of the component and its effect on the potential of the solid solution. 25 ref.

6a-39. Protection for the "Mothball Fleet". *Inco,* v. 22, Spring 1948, p. 14-15, 28.

Methods used to keep U. S. Navy inactive vessels free of corrosion, by means of "cocoon" coverings and dehumidifying chemicals and systems.

6a-40. Nitric Acid. *Chemical Engineering,* v. 55, April 1948, p. 219-220.

Part III of a symposium in which construction materials are evaluated for nitric acid services. Worthite by E. T. Collinsworth, Jr.; Nickel, Nickel Alloys by W. Z. Friend; and Protective Coatings. Refers to plastic materials.

6b—Ferrous

6b-26. Nitric Acid Versus Construction Materials. *Chemical Engineering,* v. 55, March 1948, p. 225-226, 228, 230, 232, 234.

Part II of a symposium in which typical materials of construction are evaluated for services involving nitric acid. Carbon and Graphite, by W. M. Gaylord; High-Silicon Iron, by Walter A. Luce; Stainless Steel, by Grant L. Snair, Jr.; and Silicones, by J. A. McHard.

6b-27. Magnesium Anodes for Protecting Water Heaters and Storage Tanks. *Modern Metals,* v. 4, March 1948, p. 32-34.

Research in galvanic corrosion of dissimilar metals as applied to gas hot-water storage heaters, sponsored by Committee on Domestic Gas Research, A.G.A.

6b-28. Corrosion Control in Mid-Continent Oil Production. C. G. Munger. *Brush and Spray,* v. 1, March 1948, p. 1-3.

Previously abstracted from *World Oil.* See item 6-309, R.M.L., v. 3, 1947.

6b-29. Rate of Breakdown and Mechanism of Nitrite Inhibition of Steel Corrosion. Rowena Pyke and Morris Cohen. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 63-78.

The effect of temperature and concentration. The end breakdown product of nitrite was identified and the effect of ratio of cathodic and anodic areas on consumption of nitrite was determined. Rate of consumption was found to be dependent on rate of steel corrosion. A mechanism of reduction of nitrite by adsorption at anodic areas followed by reduction of cathodic hydrogen to give an adherent protective oxide is proposed. (To be presented at meeting of the Society, Columbus, Ohio, April 14-17, 1948.)

6b-30. Corrosion Prevention Begins With Construction. Wm. E. Huddleston. *Petroleum Engineer,* v. 19, March 1948, p. 154, 157, 160.

Recommended procedures for corrosion prevention in pipe-line construction.

6b-31. Effect of Atmospheric Corrosion on Maintenance and Economics of Overhead Line Hardware and Guy Strand—Part I. C. J. Couy. *Corrosion,* v. 4, April 1948, p. 133-140.

Results of an engineering study of the aging or "wearing" characteristics of component materials and of application to the problem of the information so secured. Protection afforded by various metallic coatings; corrosion of the different ferrous alloys used. (Presented at annual meeting, N.A.C.E., Chicago, April 7-10, 1947.)

6b-32. Testing and Selection of Inhibitors for Corrosive High Pressure Condensate Wells. D. A. Shock. *Corrosion,* v. 4, April 1948, p. 179-185.

Reviews methods thus far devised for testing inhibitors and requirements of a satisfactory inhibitor. 23 ref.

6b-33. Steam Turbine Lubrication Problems and Their Solutions. Part 5. "Secondary" or "Acid Condensate Corrosion" Rusting (1). *Petroleum,* v. 11, April 1948, p. 86-87, 98.

Reviews previous articles of series. Mechanism of "secondary" rusting and its prevention; and the oxidation of solvent-refined and "conventionally" refined turbine oils. (To be continued.)

6b-34. Prevention of Drill String Failures in the Permian Basin. Part I. Robert C. McMaster. *World Oil,* v. 127, April 1948, p. 75-80, 82.

Methods followed in research on the problem at Battelle Memorial Institute and conclusions based on observed results.

6b-35. Corrosion Fatigue of Oil Well Equipment. B. B. Morton. *World Oil,* v. 127, April 1948, p. 156, 158, 160, 162, 168.

Fundamental principles of corrosion fatigue and use of nickel alloys and other methods for prevention or minimization. Examples of corrosion fatigue cracks.

6b-36. The Why, How and What of Pipe Line Corrosion. M. E. Parker, Jr. *World Oil,* v. 127, April 1948, p. 184, 186, 188, 190.

Fundamentals and methods of prevention.

6c—Nonferrous

6c-8. Etude des Traces Noires Produites sur la Peau et les Etoffes par le Port de Bijoux en Or. (Study of Black Streaks Produced on the Skin or Cloth From the Wearing of Gold Jewelry.) Marcel Ballay and Pierre Vogt. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 256-260.

Jewelry of various types was tested on numerous wearers and under controlled conditions to determine the reason for streaks. It was found that there is less effect from solid pieces than from chains or other cutwork and that it is caused by the abrasive action of dust and other foreign matter, not by corrosion caused by reaction with skin secretions.

6c-9. Passivity of Chromium. Norman Hackerman and D. I. Marshall. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 49-54.

Surfaces of chromium, treated with nitric acid and then oxidized in air at various temperatures, were examined by electron diffraction and results correlated with results of electrode-potential measurements on other samples subjected to the same treatments. Air-passivation treatment was compared with nitric acid passivation. It was concluded that an oxide film is not the fundamental criterion of passivity in the case of chromium; but that the presence of such a film can greatly influence the potential. (To be presented at meeting of the Society, Columbus, Ohio, April 17, 1948.)

6d—Light Metals

6d-7. The Corrosion of Metals—Part IX. Magnesium and Its Alloys. (Continued.) *Sheet Metal Industries,* v. 25, March 1948, p. 541-546.

Galvanic corrosion and its relation to design; stress-corrosion; and corrosion-fatigue.

6d-8. Corrosion of Metals With Oxygen Depolarization. (Continued.) *Light Metals,* v. 11, March 1948, p. 155-160.

This section of condensation of, and commentary on, Russian book by N. D. Tomashoff deals with cathode characteristics with special reference to aluminum and its alloys. (To be continued.)

6d-9. The Corrosion of Aluminum is Shown in the Return of Eros. *Light Metal Age,* v. 7, April 1948, p. 6-9, 26.

Results of close examination of the condition of famous London statue. Details of its condition after 54 years' exposure, of some little known features in its construction and assembly, of certain repairs and renovations effected prior to rein-

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TOOLS FOR TESTING

section are prevented. Shaped refractory insulators, surrounded by high-temperature insulation, minimize thermal losses.

Furnace temperature may be controlled by one of several systems depending on the purpose for which the unit is installed. Proportioning devices may be used to assure rapid response and to eliminate a dead zone at the control point. Control temperature may be registered continuously by use of a multiple-point recording pyrometer. The furnace has particular application for creep tests, but can be used for any type of high-temperature test such as tensile, fatigue, shear or stress-rupture tests.

A new motor-driven screw-type creep testing machine of 20,000 lb. capacity, designed for short-time creep-rupture tests at high temperatures, has just been announced by Baldwin Locomotive Works **(427)**. The machine automatically maintains constant loads up to 100,000 psi. on standard 0.505-in. diameter specimens, while temperatures are held constant up to 2200° F. Tests of this type may run for 10 to 400 hr.

A feature of the machine is a flat chart recorder panel in front, with which no extensometer is required and no strain readings need be made. The elongation versus time curve is automatically and accurately drawn on the chart from the start of the test until rupture occurs. Thus, greater accuracy at the final point of the curve, or for plastic strain at rupture, is attained than by the conventional practice of measuring after rupture by fitting the two broken ends of the specimen together. Elongation is also indicated by a revolution counter which can be read directly in thousandths of an inch.

The new machine can also be adapted readily to short-time tensile tests, constant strain-rate tests, or relaxation tests.

Laboratory Equipment

In the field of electron microscopy, Radio Corp. of America has announced experimental development of a new electron diffraction camera **(428)** that will further the technique of studying submicroscopic surfaces of metals. The new camera, in conjunction with the electron miscroscope, will be used in investigations of corrosion and rust, surface hardening of metals, and roller bearing surfaces.

R.C.A. is also experimenting with a new double lens **(429)** to increase the light contrast in photographs made with the electron microscope, and a new light optical viewer **(430)** to provide increased magnification for direct observation of electron microscope images.

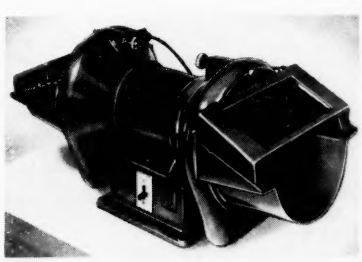
A method of microscopy in color, without the use of dyes or light filters, is termed "dispersion staining" by Bausch & Lomb Optical Co. **(431)**, where the technique was originated. It will be useful in checking minerals or ores for impurities, since different materials in a sample appear a different color when the sample is placed in the correct immersion liquid and then viewed with standard microscope equipment.

The light from the microscope lamp is passed through a darkfield substage lens to strike the sample at a high angle. The high-dispersion liquid covering the sample matches the light-bending ability of different materials in the sample at different portions of the color spectrum. Each material then scatters some of the colors present in the white light into the microscope where they are seen by the observer, while other colors pass directly through the sample at such a high angle that they do not enter the microscope.

New developments in metallurgical sample preparation announced by Buehler, Ltd., include two new wet power grinders, one a floor model and one a bench model **(432)**. Both models have two 12-in. diameter steel-backed wheels, one at either end of a 3/4-hp. motor. The wheels revolve at 1750 r.p.m. Water or other lubricant is fed to the wheels through separately controlled outlets. The floor model has a built-in tank and pump as well as a spare wheel compartment. The working surface is illuminated by a concealed lamp and covered by a large, transparent safety shield.

An extra accessory available for either machine is a hand-powered screw-fed diamond dressing tool.

Another new Buehler grinder is a wet belt surfacer of dual construction so that two belts with different abrasive grits can be used simultaneously **(433)**. The motor has two speeds—1600 and 3200 ft. per min. for fast or slow grinding. Water jets and a drain system are provided. The belts are 4 in. wide and length of grinding area is 6½ in.



Buehler Grinder for Sample Preparation, Bench Model

Two new magnetic stirrers are being manufactured by Precision Scientific Co. **(434)**. One, the Magne-Mix, is operated electrically; the Aero-Magne-Mix is operated by air and is recommended where explosive vapors or inflammable liquids are present.

Precision Scientific Magnetic Stirrer

These stirrers are designed for agitating liquids under pressure, in a vacuum or in a closed system, with either large or small quantities of solution. The motor has sufficient torque to stir an 80% glycerol solution vigorously. In both models a rotating magnetic field induces variable speed stirrer action.

Burrell Technical Supply Co. **(435)** has introduced a "wrist-action" shaker that simulates hand shaking of flasks or bottles. Specially designed finger-grip clamps will hold a wide variety of volumetric flasks, round or square bottles, erlenmeyer flasks, and test tubes. The shaker is available in three sizes, for 8, 12 and 16 flasks respectively.

A dilatation interferometer for measuring the coefficient of thermal expansion of small solid specimens is described and illustrated in a new booklet by Gaertner Scientific Corp. **(436)**. The assembly consists of interferometer, viewing apparatus, light source, furnace and control, and potentiometer pyrometer.

Measurements are made by placing three equal specimens between the interferometer plates in the furnace, and noting through the viewing apparatus the passage of interference fringes, at temperatures given by the potentiometer. The number of fringes multiplied by 0.000273 (one-half the

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statement, and of the method employed to clean the deposited grime from the aluminum surface to reveal the true character of the underlying patina.

For additional annotations indexed in other sections, see:
7b-71; 8-73-91; 24b-50.

7 CLEANING and FINISHING

7a—General

7a-66. Deposition of Nickel and Cobalt by Chemical Reduction. Abner Brenner and Grace Riddell. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 156-169; discussion; p. 169-170.

Previously abstracted from *Journal of Research of the National Bureau of Standards.* See item 7-501, R.M.L., v. 4, 1947.

7a-67. Some Properties of Aluminum Flake Powders. Part 2. Gunter W. Wendon. *Paint Manufacture,* v. 18, Feb. 1948, p. 45-47.

Properties which are connected with color, including dyed powders, and use of aluminum flake in polychromatic paints.

7a-68. Barrel Finishing of Metal Products. Part 19—The Use of Wood-Lined Barrels for Abrasive Operation and the Relation of Barrel Size to Size of Parts to Be Processed. H. Leroy Beaver. *Products Finishing,* v. 12, March 1948, p. 50, 52, 54, 56, 58, 60, 62.

7a-69. Finishing Clinic. Allen G. Gray. *Products Finishing,* v. 12, March 1948, p. 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94.

New methods for treatment of plating-room wastes; protective metallic coatings from salt baths; new instrument for measuring flexibility and adhesion of surface coatings; surface preparation before painting exterior steel surfaces.

7a-70. Cleaning Small Parts. John E. Hyler. *Products Finishing,* v. 12, March 1948, p. 96, 98.

Use of basket immersion and air drying.

7a-71. Chromated Protein Films for the Protection of Metals. Abner Brenner, Grace Riddell, and Robert Seegmiller. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 55-62.

Process developed for protecting steel, zinc, aluminum, and brass from corrosion. Either casein, albumin, or gelatin is applied to the metal surface by dipping. The film is impregnated with chromate, which acts as an inhibitor of corrosion and hardens the film, by adding the salt to the protein solution or by separate immersion. These films may be useful for the protection of certain metals in mildly corrosive atmospheres. (To be presented at meeting of the Society, Columbus, Ohio, April 14-17, 1948.)

7a-72. Handling Rush Jobs in a Custom Shop. G. A. Conrad. *Industrial Finishing,* v. 24, March 1948, p. 50-52, 57.

Tips in metal finishing field.

7a-73. Cleaning, Bonderizing and Prime Coating Automobile Wheels. Fred M. Burt. *Industrial Finishing,* v. 24, March 1948, p. 58-59, 62, 64, 66.

Operation of a practical mechanized setup for cleaning, rust-proofing and painting automobile wheels—a setup which is applicable to other metal parts and products.

7a-74. Flow-Coating of Farm Machinery. Norman H. Voigt. *Industrial Finishing,* v. 24, March 1948, p. 67, 70-71, 74, 76.

Use of flow-coat system for painting certain types of heavy farm and road-building machinery. Composed of angle iron, rods, springs sprockets and brackets, these huge machines are a complex array of heterogeneous parts. This fact makes either a dipping or flow-coat system almost mandatory.

7a-75. Health Hazards of Metal Cleaning Compounds. Part IV. P. M. Van Arsdell. *Organic Finishing,* v. 9, March 1948, p. 38-43.

Chlorinated solvents. 29 ref.

7a-76. Engraving Conical Metal Surfaces; A Chemical Etching Process. E. W. Jackson. *British Printer,* v. 60, March-April 1948, p. 20-23.

Method developed for engraving families of nonlinear curves on the above, which are required for various artillery-firing-control instruments. A modified letterpress printing process using a rubber printing surface and a simple hand-driven machine of special design.

7a-77. Molten Salt Bath Descaling Provides Greater Metal Savings. *Steel,* v. 122, March 29, 1948, p. 90.

How the problem of scale removal from hot-rolled clad plate and sheet, including stainless, nickel, and monel, was solved.

7a-78. New Development in Metallizing. *Industry and Welding,* v. 21, April 1948, p. 60-61.

Method involves use of a metal in wire form which may be sprayed with any metallizing gun directly on to smooth steel and many other materials without any surface preparation.

7a-79. The Cleaning of Metals. Part IV—Emulsifiable Cleaners. Part V—The Cleaning Machines. (Concluded.) R. Groves. *Metallurgia,* v. 37, Feb. 1948, p. 217-219; March 1948, p. 267-268.

7a-80. Metal Spraying by the Wire Process. W. E. Ballard. *Journal of the Birmingham Metallurgical Society,* v. 28, March 1948, p. 37-50; discussion, p. 51-61.

Describes above process. Includes sound-film script on the subject.

7a-81. Barrel Finishing for Mass Production. Herbert Chase. *Metal Finishing,* v. 46, April 1948, p. 56-60.

Use at Endicott, N. Y., plant of IBM for some 8500 different parts ranging from gray-iron castings about 2½ x 4 x 14 in. overall and weighing about 6 lbs., to tiny parts weighing a small fraction of an ounce. Zinc die castings, steel forgings, scores of screw-machine products, hundreds of stampings in steel, brass, and aluminum, and a wide assortment of other products are regularly subjected to surface treatment in barrels of many sizes and types.

7a-82. Methods of Evaluation of Industrial Finishes. R. A. Pringle and E. M. Yacko. *Paint and Varnish Production Manager,* v. 28, April 1948, p. 108, 110-113.

Procedure used in testing and evaluating organic finishes to be used on appliances.

7a-83. Roto-Finish Spurs Finishing Economies. Arthur P. Schulze. *Tool Engineer,* v. 20, April 1948, p. 35-37.

Recently developed technique is a versatile barrel-finishing process which makes possible four basic types of mechanical finishing: grinding for deburring; polishing; "britehoning"; and wet coloring using steel balls of various sizes or suitable coloring media. Consists essentially of using specified wet mixtures of chips and compounds in controlled rotary action for a variety of finishing jobs.

7a-84. Glycerine in Finishes for Metal Products. Georgia Leffingwell and Milton A. Lesser. *Products Finishing,* v. 12, April 1948, p. 46, 48, 50, 52, 54.

A review. 28 ref.

7a-85. Barrel Finishing of Metal Products. Part 20—Continuing the Discussion of the Use of Pebble and Fractured Mineral Forms in Barrel Finishing Procedure. H. Leroy Beaver. *Products Finishing* v. 12, April 1948, p. 58-60, 62, 64, 66, 68.

7a-86. Finishing Clinic. Allen G. Gray. *Products Finishing,* v. 12, April 1948, p. 74, 76, 78, 80, 82, 84, 86, 88, 90, 92.

The following new developments: phenolic-resin coatings baked by induction heating; electropolishing of silver; importance of proper rinsing following alkali cleaning operations; synthetic rubber derivatives as corrosion-resistant coatings; and anodic coating for magnesium.

7a-87. Conveyorized Infrared Equipment Improves Production and Quality at Allen. *Products Finishing,* v.12, April 1948, p. 94, 96, 98.

Use in finishing bookkeeping machines, adding machines, calculators, and cash registers.

7a-88. Plastic Coating Protects Chromium Plated Parts During Assembly. *Products Finishing,* v. 12, April 1948, p. 98.

Use during spray painting.

7a-89. Organic Coatings for Metals. E. E. McSweeney. *Plating,* v. 35, April 1948, p. 340-343.

Composition in relation to performance, various factors which should be considered in selecting a coating for a specific application, including the cost item, wherein cost per finished article is said to be more important than cost per gallon.

7a-90. Stripping of Electrodeposits. Norman D. Hoffman. *Plating,* v. 35, April 1948, p. 351-352, 404.

Immersion and electrolytic types of stripping processes and recommended procedures for the various plated and base metals, with consideration of other factors as well.

7a-91. Some Recent Developments in Synthetic Resins for Protective Coatings. L. R. Whiting. *American Paint Journal,* v. 32, April 19, 1948, p. 72, 74, 76-79, 82.

Studies and results obtained in an attempt to produce a coating that would serve both as an inhibitive wash coat and a temporary anticorrosive primer. Also briefly describes an instrument, the "Protectometer", for evaluating protective films on metal in various environments.

7b—Ferrous (Base Metal)

7b-46. Coatings Research. *Iron and Steel,* v. 21, March 1948, p. 87-90.

B.I.S.R.A. laboratories and equipment for coatings research at Swansea, South Wales. Deals only with inorganic (mainly metallic) coatings on sheet steel.

7b-47. Metal Diffusion; German Use of Methods of Gaseous Metal Treatment. *Iron and Steel,* v. 21, March 1948, p. 91. Condensed from B.I.O.S. Report No. 1535.

Surface impregnation of ferrous articles by the Ihrig process with either silicon or aluminum.

7b-48. Protective Coverings for Marine Applications. Rolt Hammond. *Paint Manufacture,* v. 18, March 1948, p. 79-83.

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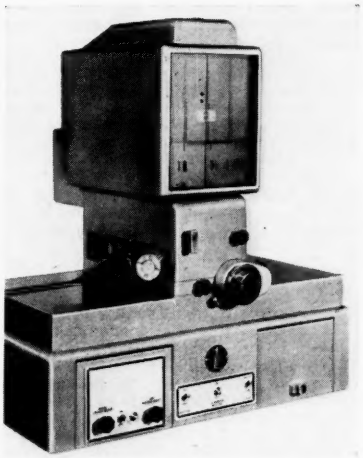
TOOLS FOR TESTING

wave length of the mercury green light used) gives immediately the expansion of the specimens in millimeters. An interesting use for the instrument is in comparing dilatation curves of materials which are to be fused together, such as metal and glass or vitreous enamel.

A corrosion test humidity cabinet —a product of Precision Scientific Co. **(437)**—produces a moisture-saturated atmosphere with continuous condensation on test specimens. It fulfills the requirements of Army-Navy Aeronautical Standard Specification No. AN-H-31, as well as for other tests requiring extreme temperature-humidity conditions. A revolving stage specimen rack, accommodating 33 test panels, rotates at 1/3 r.p.m. The cabinet is electrically heated and thermostatically controlled from room temperature to 150° F. (± 2°), and is equipped with air disperser and air flowmeter.



Film Comparator-Densitometer Made by Applied Research Laboratories

Analysis

The Quantometer—a direct-reading instrument for spectrochemical analysis developed by Applied Research Laboratories **(438)**—was described in the December 1947 issue of *Metal Progress*, page 975. A new recording system for this instrument has now been devised which employs removable plastic panels fitted with direct-reading scales for each element being determined. Panels can be made up for each type of alloy, and the instrument can be set up for the analysis of any alloy of a certain base metal in a few minutes.

Improvements have also been made in Applied Research Laboratories' two-meter spectrograph **(439)**, which employs unusually fine original gratings, with large numbers of ruled lines per inch, so that high dispersion is achieved in a relatively compact instrument. By fixing two different gratings on the Rowland circle and moving the incident beam from one to the other, the instrument can be quickly changed from a condition of high dispersion (with the 36,600 line per in. grating) to one of greater spectrum coverage (with the 24,400 line per in. grating). For photography, a standard camera which photographs 20 in. of spectrum is provided. The ultimate in spectrum coverage is obtainted with two cameras, which will photograph 40 in. of spectrum at one time.

Another new development of Applied Research Laboratories is the Model 5400 film projection comparator-densitometer **(440)**, for making comparisons with master films and obtaining transmission readings of spectrum lines photographed on 35-mm. spectrum analysis film. The instrument has two film stages for moving the sample film and the master film individually. Small portions of each film are projected with 20-fold magnification on a green translucent screen.

Transmission readings are made by mechanically scanning a line with a 0.0007-in. slit. The light coming through the slit is picked up by a photo tube, amplified by a linear system and converted into transmission readings by a projection galvanometer. These readings are projected on the screen near the image of the line being measured. The master film supplied is 5 ft. long, giving at least three lines of all elements detectable from 2100 to 8900 Angstrom units.

The Coleman Junior spectrophotometer, distributed by Wilkens-Anderson Co., and described in the December issue of *Metals Review*, page 19, has a companion model in the Coleman Universal spectrophotometer **(441)**. Both instruments have direct-reading, removable scales, graduated in percent transmission and density figures. The optical system, light source, grating and photocell are much alike. While the range of the Junior, however, is 400 to 700 $m\mu$, the Universal will work down to 320 $m\mu$ or up to 800 $m\mu$. The Universal also has a sliding carrier on the top, which makes for faster work and easier manipulation since both reference and sample tubes are in position.

The Eberbach Electro-Analysis Apparatus for analysis of metals by the electrodeposition method has been redesigned by Eberbach & Son Co. **(442)** with a front panel of stainless steel and sides of cast aluminum. Special stainless steel spring-grip electrode holders facilitate handling of the platinum electrodes. The apparatus has flat sides for "banking" if numerous determinations are to be made simultaneously.

Nondestructive Tests

Flaw Detection and Surface Analysis

Production-line inspection for flaws by magnetic particle methods is proceeding apace, as evidenced by a machine exhibited in operation by the Magnaflux Corp. **(443)** at the National Metal Exposition in Chicago last fall. This is a conveyor-type unit which carries the parts on special jigs under a Magnaglo hood, where cracks and flaws are readily detected. Forgings and similar high-volume parts can be inspected in this way almost immediately after the forging or stamping operation, and when defects show up, processing can be corrected without delay.

Welds in ferrous metals and light metals can be inspected for lack of bond, for inclusions or voids by a newly developed testing technique employing high-frequency sound waves generated by a Supersonic Reflectoscope, according to Sperry Products Co. **(444)**. The method is known as angle beam transmission—that is, the sound beam enters the welded part at an angle.

The searching unit, whose primary element is a quartz crystal, can be placed on the smooth parent metal adjacent to the weld, or even at some distance from it. The energy travels by successive reflections between the surfaces of the material until an interface is reached. The weld metal itself will not constitute a reflecting interface, but any voids or inclusions will reflect part of the sound beam back to the searching unit where it will be amplified to provide a vertical deflection of the horizontal trace on an oscilloscope screen. Distance from the searching unit to the flaw is determined by calibration, and it is thus possible to distinguish between any defects in the plate and those in the weld area.

The latest piece of equipment in

(*Turn to page* 21)

Weld Inspection by Reflectoscope

For Bulletins and Further Information, Use Reader Service Coupon on Page 23

Effects of marine fouling; fouling characteristics of ports; plant fouling; anti-fouling studies; effect of toxins; recent research results; uses of asphalt; bituminous paints; protection of internal surfaces; Admiralty Corrosion Committee tests; use of plastics; and flame-spraying applications. 12 ref.

7b-49. Present-Day Need for the Determination of Weight of Nickel Deposit. J. M. Zander. *Better Enameling*, v. 19, March 1948, p. 6-8.

The value of a nickel dip in preparation of steel surfaces for vitreous enameling has been clearly demonstrated. It has been observed that weights of Ni deposits vary over a wide range, especially when using nonuniform steels. Recommends determination of the weight of deposit as a control procedure for achieving higher quality and fewer rejections.

7b-50. Patterning Stainless Steel. *Electroplating*, v. 1, March 1948, p. 203-204.

Methods for producing permanent designs in various shades of yellow, brown, and black by either chemical oxidation or anodizing.

7b-51. Immersion Burner Heating Versus Steam Coil Heating in the Pickle Room. F. W. Schlensker. *Enamelist*, v. 25, March 1948, p. 12-14.

Pros and cons of the two methods, including costs.

7b-52. Paint Finishing Using Direct Oil-Fired Air Heaters. Barry F. McLaughlin *Enamelist*, v. 25, March 1948, p. 15-17.

Refers to porcelain enameling.

7b-53. Finishing the Evans Space Heater. Robert B. Evans. *Products Finishing*, v. 12, March 1948, p. 22-24, 26.

Procedures used by Evans Products Co. in organic finishing.

7b-54. Steel Wears a Light Coat. Ralph P. Brown. *Steelways*, March 1948, p. 12-15.

Production of enameled steel and various uses.

7b-55. Antifouling Coating Tested by Scientists. R. J. McMahon. *Brush and Spray*, v. 1, March 1948, p. 4-5. Reprinted from *Motorship*.

Development of Amercoat copper-flake antifouling paint by research men at Battelle Memorial Institute, and its testing both by seawater exposure of panels and by service on a tuna clipper. Results show marked superiority over other coatings.

7b-56. Post War Progress in Porcelain Enamels; Improved Steels, Enamels and Opacifiers Bring Huge Growth to the Industry. *Rohm & Haas Reporter*, v. 6, March 1948, p. 4-7.

7b-57. Conveyerized Finishing. *Organic Finishing*, v. 9, March 1948, p. 49-50.

At Crosley Corp.'s refrigerator plant at Richmond, Ind.

7b-58. Porcelain Enameling in Italy; Including Description of Interesting Equipment and Methods. Paul A. Huppert. *Finish*, v. 5, April 1948, p. 17-20, 70, 72.

7b-59. How to Choose the Correct Type of Porcelain Enamel for Specific Applications. Part II. J. E. Hansen. *Finish*, v. 5, April 1948, p. 25-26, 66.

Types to use for kitchen utensils; gas and electric ranges; resistance to crazing; exteriors of refrigerator cases; refrigerator interiors; washing-machine tubs and component parts; table tops; plumbing ware; signs; architectural panels; hot water tanks; protection against high-temperature corrosion; protection against wear and abrasion; and industrial applications.

7b-60. Production of Range Platforms —Cover Coat Enamel Direct to Steel; A Progress Report. J. B. Simons. *Finish*, v. 5, April 1948, p. 36-37.

Encouraging progress at Electric Appliance Division, Westinghouse Electric Corp., Mansfield, Ohio. One of the most important results is the indication that Ti-bearing killed steel is satisfactory for direct white applications.

7b-61. Metal Coatings by High Vacuum Evaporation. Philip Godley. *Iron Age*, v. 161, April 1, 1948, p. 90-94.

Fundamental aspects of evaporated coatings, and units for both continuous and batch-type work. Physical characteristics of such coatings and some interesting applications including the coating of thin plastic sheeting and condenser paper.

7b-62. Sodium Hydride Effective in Descaling Stainless Steel Sheets. M. H. Lebowitz. *Steel*, v. 122, April 5, 1948, p. 107, 110, 112.

Surface quality is improved and finishing operations speeded by use of a molten sodium hydroxide bath, impregnated with sodium hydride, at Wood Works, Carnegie-Illinois Steel Corp.

7b-63. Flame Cleaning. G. W. Rigby. *Coke and Gas*. v. 10, March 1948, p. 89-95.

Details of the oxygen flame-cleaning process for the removal of scale and corrosion products before painting.

7b-64. Metal Cleaning Processes—Part II. Uses of Alkaline Solutions. L. Sanderson. *Chemical Age*, v. 58, March 6, 1948, p. 331-333.

Used on various nonferrous metals and alloys. (To be continued.)

7b-65. Modern Porcelain Enameling. Part I. G. H. Spencer-Strong. *Ceramic Industry*, v. 50, March 1948, p. 96, 98, 100.

First of a series. Choice of equipment and plant layout. (To be continued.)

7b-66. Porcelain Enamel Process Defects. Part II. M. E. McHardy *Ceramic Industry*, v. 50, March 1948, p. 102.

Blistering, and boiling. (To be continued.)

7b-67. How to Prevent Defects in Porcelain Enameling Hollowware; Waterlining. Part 2. F. A. Petersen. *Ceramic Industry*, v. 50, March 1948, p. 104.

Recommended procedures. (To be continued.)

7b-68. Liquid Honing. *Aircraft Production*, v. 10, April 1948, p. 130-131.

Use of wet abrasive blasting for impeller finishing.

7b-69. Plates Prepared With Steel Grit. *Welding Engineer*, v. 33, April 1948, p. 60, 62.

Development of a portable blasting unit that can be located anywhere in the production line to clean plate for automatic welding.

7b-70. Hard Facing Improves Tool Life. Louis Barrett. *American Machinist*, v. 92, April 8, 1948, p. 94-95.

Application of hard facing material by metal spraying and subsequent fusion can increase performance of friction surfaces up to 14 times that of original material.

7b-71. Integrated Cleaning and Rustproofing. *Steel*, v. 122, April 12, 1948, p. 90-92.

Process and equipment used in finishing of outdoor metal furniture. A phosphate is used for rustproofing.

7b-72. Decorating With Full Color Porcelain Enameled Murals. *Iron Age*, v. 161, April 15, 1948, p. 94.

7b-73. Uniform Tank Coatings. R. W. Thrasher. *Steel*, v. 122, April 19, 1948, p. 76-80, 112, 114.

Use of a completely conveyerized setup for hot-dip galvanizing, assembly, and resistance welding of tank shell and head units and separate dome-shaped bottoms. Relative concentration of zinc in and around weld area and other problems affecting efficiency of finished tanks were studied carefully to develop the fabricating methods followed.

7c—Nonferrous (Base Metal)

7c-12. The Evaporation of Gallium. S. K. Haynes. *U. S. Atomic Energy Commission*, MDDC-1604, April 2, 1947, 3 pages.

Laboratory technique developed for vapor deposition of gallium.

7c-13. Production Clinic for Finishing Die Castings. *Die Castings*, v. 6, April 1948, p. 63-64, 66-67.

Lacquers as finishing materials for die-cast products; copper strike for zinc die castings; anodizing aluminum alloys; surface treatment for magnesium; and extraction methods applied to analysis of electroplating baths.

7c-14. Chromating of Zinc. C. D. Leonard. *Electroplating*, v. 1, April 1948, p. 241-246.

Existing practice and latest developments.

7d—Light Metals

7d-12. Anodizing and Dyeing; Practical Experiences and Final Conclusions. K. E. Langford. *Electroplating*, v. 1, March 1948, p. 215-218 A condensation.

Technical difficulties encountered in setting up a shop for anodizing and dyeing of aluminum and its alloys, and their solutions. Practical aspects, especially for the dyeing process, in which a wide variety of colors are applied. (Presented at meeting of Electrodepositors' Technical Society, Birmingham, England, Jan. 6, 1948.)

7d-13. Heat Resistant Silicone Finishes. E. J. Bromstead and M. A. Glaser. *Organic Finishing*, v. 9, March 1948, p. 21-26.

For coating of aluminum. Comparative heat resistances of silicone and oleoresinous finishes on sheet Al. Properties of the former in contact with various chemical solutions and commercial products, with regard to exposure to weathering and to high humidity, and with regard to flexibility and resistance to impact and abrasion. Application, surface pretreatments and uses.

7d-14. Machines for Fabricating Enameled Aluminum Roofing. *Sheet Metal Worker*, v. 39, March 1948, p. 112.

Production at Robbins Metals, Spokane, Wash.

7d-15. Wire Brushing Provides Finish for Light Metal Parts. *Products Finishing*, v. 12, April 1948, p. 98, 100.

Use by a railroad supplier manufacturing heavy-duty air brakes.

7d-16. Power Brush Uses Increased in Light Metal Finishing. *Steel*, v. 122, April 12, 1948, p. 114.

A few new uses in the plant of a railroad supplier for production as well as special jobs.

7d-17. Painting Aluminum Structures. Robert I. Wray and Junius D. Edwards. *Paint, Oil and Chemical Review*, v. 111, April 15, 1948, p. 16, 46, 48, 50, 53-54.

Recommended procedures for surface preparation and for paint selection and application. Performances of different paints on different Al alloys, and under different service conditions.

For additional annotations indexed in other sections, see:

6d-9; 8-73-81-82; 9a-28; 11-66; 16a-30; 16b-30; 21a-58; 21b-37; 23b-21-22 27a-53.

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TOOLS FOR TESTING

the field of surface roughness measurement is Physicists Research Co.'s Proficorder **(445)**, a rugged, compact, movable recording instrument for use in the shop. Its history and functions are described in detail on page 25 of this issue.

Exact comparison of two surfaces, such as a finish standard and a production finish, can be made quickly and conveniently in a portable Faxfilm dual projection unit recently redesigned by Faxfilm Co. **(447)**. Faxfilm replicas of the surfaces to be compared are projected in twin micro projectors, the images appearing side by side on a screen in the base of the case at 30 diameters magnification. Frame holders are so constructed that the replicas can be moved to match direction of tool markings. One projector can be removed for use at various magnifications when comparison is not required.

For measuring flatness of surfaces, a new type of interferometer was ex-

Bausch & Lomb Interferometer

hibited for the first time during the Tool Engineers Industrial Exposition in March of this year. Made by Bausch & Lomb Optical Co. **(448)**, it differs from previous interferometers in simplicity of operation; it can be adjusted for greatest accuracy by an unskilled operator in 10 sec. or less, as compared to several hours required by a skilled technician to bring the ordinary type into proper adjustment.

The device sets up shadowlike bands of interference in light reflected between its master optical flat, which has a surface accuracy of one-millionth of an inch. and the object being tested. The master optical flat is never brought in contact with the object under inspection, so that it does not get scratched, distorted or worn. Surfaces with as much as a 4-in. recess may be viewed with the instrument.

Thickness Measurement

Measurement of thickness of parts by supersonics is exemplified in an instrument called the Reflectogage by Sperry Products, Inc. **(449)**, and the Sonigage by Magnaflux Corp. **(450)**. Its principal advantage is that it will gage thickness when access is had to one side of the part only, such as when testing long tubes, formed hollow parts, plate and sheet stock, large tanks, boilers or ship hulls. The instrument depends on the fact that a simple relation exists between the resonant frequency and the thickness of any given material.

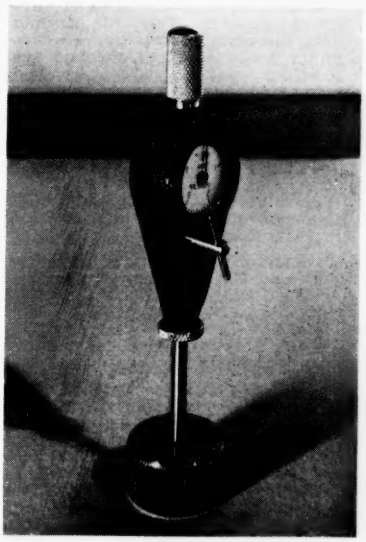
Another type of thickness gage designed for testing metallic containers, vessels and piping while in service is the Electroflux, made by Scott Electroflux Co. **(451)**. Accuracy of the instrument is unaffected by corrosion, erosion, pitting or scale formation on the metal surface or by the fluid or solid contents of the object being tested. This portable equipment consists of a 4-electrode probe, a small 6-volt battery for supplying direct current to the probe, an electronic voltmeter and power supply for measuring the low-voltage output of the probe, and interconnecting cables. Any electrically conducting material can be tested, including steel, in thicknesses ranging from 0.125 to 2.25 in.

Thickness gages for measuring steel sheet without contacting the material can be based on the absorption of either X-rays or beta rays. Westinghouse Electric Corp.'s X-ray gage **(452)** compares the controlled material to a correct sample. It employs two X-ray sources at right angles, with one photomultiplier fluorescent screen pick-up unit at the apex. The two sources emit X-rays 180° out of phase. Positive and negative readings showing the thickness differential above or below the standard sample are shown on an instrument within view of the operator.

The beta-ray gage has been developed in the research laboratory of Summit Corp. **(453)**. Radioactive strontium, which decreases to half its strength in 55 days, is ideal as a source of high-energy beta rays because of the lack of obscuring gamma radiation. An intensity meter and thickness gage was built using two Geiger counter tubes as beta-ray detectors, a conventional quenching circuit, pulse-shaping amplifiers, a pulse counter consisting of an averaging frequency meter, and a balancing circuit to indicate the change in average rate, with a meter to read directly the thickness change in thousandths of an inch.

Shop Inspection Equipment

Present-day high-speed operation of machine tools has multipled the demand for rapid, convenient and accurate measurement of parts in production. Consequently, new gages and other shop inspection devices are various and numerous, and the following brief section is by no means a complete account of new products in this field.



Nilsson Dial Bore Gage

A small dial bore gage developed by Nilsson Gage Co. Inc. **(454)** is typical of the kind of simple, foolproof equipment that gives precision results. The gage weighs about 8 oz. and the dial indicator has graduations in 0.0001 in. with a total travel of about 0.008 in. Three gages will cover a range of ⅜ to ⅞ in.

The method of setting the gage is simple and fast. The head is inserted into the master gage and the spring-tensioned range extension is released as the gage is tilted on a slight angle. One twist of the locking sleeve automatically locks the range extension. When the range is determined, fine adjustments to size on the indicator are made with a simple key arrangement that automatically seals the gage.

The Model G Studler angle computer—Angle Computer Division, S & D Engineering Corp. **(455)**—is a pre-

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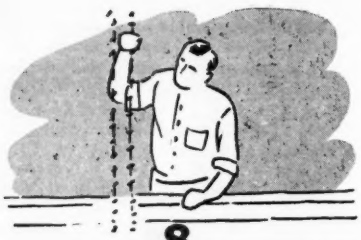

8 ELECTRODEPOSITION and ELECTROFINISHING

8-61. A Theory for the Mechanism of Chromium Plating; A Theory for the Physical Characteristics of Chromium Plate. Cloyd A. Snavely. *Electrochemical Society, Preprint* 92-35, 1947, 39 pages.

Structural characteristics of chromium plating. New fundamental data on crystal structure of chromium deposited from chromic acid solutions.

8-62. Electroplating on Aluminum and Its Alloys. T. A. Hood. *Munitions Supply Laboratories, Department of Munitions, Commonwealth of Australia, Information Circular* 10, Oct. 1947, 41 pages.

An abstracted bibliography of 82 items covering the years 1918-1947 in chronological order.

8-63. Some of the Effects of Cadmium, Zinc, and Tin Plating on Springs. John R. Gustafson. *A.S.T.M., Advance Print* AP5, 1947, 21 pages; discussion, p. 18-21.

Data obtained from fatigue and salt-spray tests.

8-64. The Physical Properties of Electrodeposits; Annual Report on A.E.S. Research Project No. 9. Abner Brenner and Charles W. Jennings. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 25-29; discussion, p. 29-31.

Plans for work on nickel deposits.

8-65. Physical Properties of Electrodeposited Chromium. Abner Brenner, Polly Burkhead, and Charles W. Jennings. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 32-72; discussion, p. 72-73.

Previously abstracted from *Journal of Research of the National Bureau of Standards.* See item 8-31, 1948.

8-66. Stress in Electrodeposits—Its Significance. K. Gustaf Soderberg and A. Kenneth Graham. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 74-96; discussion, p. 111-114.

Reviews published information. Results of experiments on Cu-Ni-Cr plated steel. Four types of cleaning procedure were used on steel panels prior to plating with the three layers. They were then exposed three months to an industrial atmosphere (Pittsburgh). Results were inconclusive since fine edge-cracks were only apparent after intensive cleaning. However there was some difference in appearance. A method for determination and calculation of internal stress and data for nickel deposits. 34 ref.

8-67. Stress in Electrodeposited Nickel. W. M. Phillips and F. L. Clifton. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 97-110; discussion, p. 111-114.

Quantitative method for determination and evaluation of stress, and its effect on serviceability of the electrodeposited metal; reasons for the detrimental effect; and ways to minimize these effects.

8-68. Electroforming Pitot Static Tubes. Alfred S. Kasdan. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 115-120; discussion, p. 120-121.

Mode of operation of copper tubes. Why electroforming was chosen for their manufacture by Killsman Instrument Division of Square D Co., and describes the process briefly.

8-69. Manufacturing Process for Standard 60-In. Reflectors; War Department. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 122-127.

Manufacture by electroforming of 60-in. all-metal reflectors for U. S. Army searchlights from pure copper.

8-70. Protective Power and Porosity of Electrodeposits; Annual Report on A.E.S. Research Project No. 6. N. Thon. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 128-131; discussion, p. 131-134.

Progress, especially with regard to coatings of metals nobler than iron such as nickel, copper, or tin.

8-71. Evaluation of Methods for Determining the Thickness of Electrodeposited Coatings; Annual Report on A.E.S. Research Project No. 7. Harold J. Read. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 135-143; discussion, p. 143-145.

The research program is concentrated on microscopic, magnetic, and chemical methods.

8-72. General Consideration of Experimental Methods in the Study of Polarization at Electrodes in Electroplating Processes; Annual Report on A.E.S. Research Project No. 8. A. L. Ferguson. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 146-155.

8-73. Recent Developments in the Use of Conversion Coatings on Zinc. J. E. Stareck and W. S. Cibulskis. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 171-178; discussion, p. 178-179.

Various electrolytic and dip-type conversion coatings on zinc. Outdoor corrosion resistance correlated with standard salt-spray results covering both white corrosion products and rusting. Resistance is correlated with thickness of plate, effect of impurities, and type of coating applied. Successful commercial uses of clear and colored coatings.

8-74. Barrel Chromium Plating. G. Dubpernell and S. M. Martin. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 180-200; discussion, p. 200.

Previous attempts to chromium plate small parts by tumbling in a barrel. Present successful methods and equipment. A rotating horizontal steel cylinder with an inside anode is used. The plate obtained is bright and can be applied to any desired thickness.

8-75. Bulk Nickel Plating. Henry Strow. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 201-206; discussion, p. 206-207.

Recommended methods and solutions for barrel plating.

8-76. Bright Brass Plating. Stanley J. Beyer. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 208-210; discussion, p. 210-212.

Improved rapid commercial method developed.

8-77. Some Effects of Copper in Nickel Plating Solutions; Annual Report on A.E.S. Research Project No. 5. D. T. Ewing and William D. Gordon. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 213-217; discussion, p. 217.

Bibliographical and experimental work accomplished and future plans. A few results with respect to corrosion resistance of deposits from impure solutions.

8-78. Extraction Methods Applied to the Analysis of Electroplating Baths—Determination of Zinc and Other Impurities in Nickel Plating Solutions; Annual Report on A.E.S. Research Project No. 2. E. J. Serfass and W. S. Levine. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 218-226; discussion, p. 227.

8-79. Modern Applications of Electroplating Solution Purification. B. C. Case. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 228-246; discussion, p. 246-248.

Designs of continuous electrolytic purification systems. Removal rates of Cu, Zn, and Fe from Ni solutions. 28 ref.

8-80. Health Hazards in the Electroplating Industry. Jerome E. Molos. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 270-275.

Results of an extensive survey of electroplating plants in St. Louis in order to evaluate potential health hazards and to submit recommendations for their control.

8-81. Evaluation of the Buffability of Nickel Deposits. R. D. Miller and A. H. DuRose. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 281-295; discussion, p. 295-297.

Development of a reliable test method and apparatus. Experiments were made to compare the buffability of Ni deposits from several types of Ni-plating solutions; to determine the effect of thickness of deposit on buffability; and to determine effect of base-metal polish on buffability of the Ni deposit. Profilometer diagrams of steel surfaces before and after plating.

8-82. Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings; Annual Report on A.E.S. Research Project No. 4. George J. Kahan. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 298-300; discussion, p. 300.

Work planned.

8-83. The Effect of Plating Conditions on the Structure of Thick Chromium Electrodeposits. J. J. Dale. *Sheet Metal Industries,* v. 25, March 1948, p. 531-539, 546.

Investigations of the microstructure of electrodeposited chromium, its relation to plating conditions, and its connection with the channel network produced by surface etching of deposits; a few experiments on the effect of heating on the microstructure of electrodeposits; and some attempts to identify minor constituents in the structure. 16 ref.

8-84. Electrolytic Polishing of Copper; Nature of the Polished Surface. M. Halfawy. *Electroplating,* v. 1, March 1948, p. 205-208.

Results of an electron-diffraction study.

8-85. Electroplating on Nonconductors; Some Practical Experiences. A. H. Stuart. *Electroplating,* v. 1, March 1948, p. 187-191.

Preference, for most applications, for colloidal graphite to provide a conducting film. Available metallic powders; silver-film production; use

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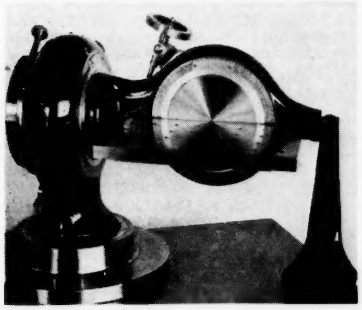
TOOLS FOR TESTING



Model G Studler Angle Computer

cision tool used for layout and inspection of tools, dies, jigs, fixtures, castings, patterns, and forgings. Since the surface plate in this instrument may be rotated 360° in each of three directions—horizontally, vertically and radially—only one setup of the work is required in most instances. It is claimed to do the job in one-half to one-tenth the time required by previous methods.

The new Model 108 comparator developed by Standard Gage Co. **(456)** has provisions for five interchangeable tables, suiting it to a wide range of production and inspection measuring jobs. Dial indicators are interchangeable so that an indicator having graduations appropriate to the accuracy desired may be used.

Standard Gage Co. has also brought out the Micronar dial indicator **(457)** which is of the quadrant type with standard mounting dimensions. The scale is divided into 0.0001-in. steps, and in the central portion these intervals have been subdivided to 0.00002 in. When this indicator is mounted on the new Model 108 comparator, the instrument can be used for such fine work as checking plug gages.

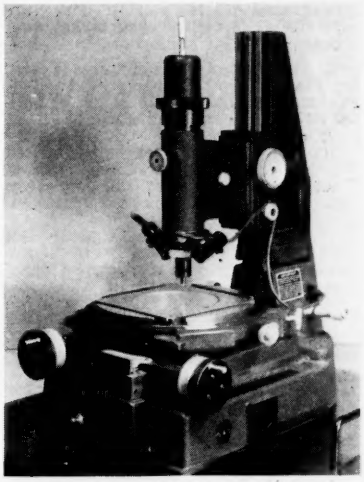
E. Leitz, Inc. **(458)**, manufacturer of precision optical instruments, has also entered the field of metrology with the introduction of a line of measuring and gaging instruments manufactured in France. Typical of the new line are the Sagem vertical metrological comparator and the Sagem universal comparator sight. The comparator is used to compare external dimensions between gage blocks (or master samples) and gages, jigs or production parts. The unit is portable and consists of a work table and comparing mechanism mounted on a common base. The universal comparator sight, used with the instrument, is graduated in units of either 0.00005 in. or 0.0001 in. A vernier is incorporated so that an additional decimal place can be read, when used under controlled temperature conditions.

A new Spencer stereoscopic shop microscope has been designed and built by American Optical Co. **(459)**. Its applications include varied industrial operations such as precision grinding, hand broaching, fine engraving, small parts inspection and die sinking. The instrument not only magnifies minute details but gives depth perception as well. It is actually a microscope for each eye. The magnified image is seen right side up so that operations can be performed under the instrument.

A useful accessory for toolmakers' microscopes, introduced by Gaertner Scientific Corp., is a spotting attachment **(460)** used for laying out drill jigs, templets and other pieces. It consists of a microscope with provisions for mounting and spinning a spotting tool on the exact point on the work at which the cross hairs have been set. There is no horizontal displacement of the microscope or stage between the operations of viewing and spotting.

Gaertner Scientific is also making a special coordinate comparator, which, while designed for a particular application in the oil well drilling industry, is readily adaptable to other coordinate measurement problems **(461)**. The range of measurement is 2x5 in. The 2-in. motion is by micrometer screw reading to 0.00005 in., and the 5-in. motion is by rapid rack and pinion, reading to 0.01 in.

A nondestructive method of differentiating parts of varying composition or heat treatment is provided by an electronic instrument called the metals comparator, introduced by General Electric Co. **(462)**. It employs a balancing network and indicating instrument mounted in a steel cabinet to which is connected an external test coil. In operation, a reference specimen is first placed in the test coil and adjustment made to secure the initial balance, indicated by a zero reading on the indicator. The reference specimen is then removed and tolerances established on the parts to be tested. The dial reading then indicates parts to be accepted or rejected. As many as 1500 small parts can be tested in an hour.



Gaertner Spotting Attachment

READER SERVICE COUPON

Check These Numbers for Production Information and Manufacturers' Catalogs. These following numbers refer to the new products and bulletins listed in the article on "Tools for Testing" starting on page 11.

THIS COUPON IS VOID AFTER AUGUST 15, 1948

Metals Review, May 1948

405	409	414	418	422	426	430	434	438	442	447	451	455	459
406	410	415	419	423	427	431	435	439	443	448	452	456	460
407	411	416	420	424	428	432	436	440	444	449	453	457	461
408	412	417	421	425	429	433	437	441	445	450	454	458	462

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of graphite; the plating bath; application to porous surfaces; and causes of poor adhesion.

8-86. An Electrolytic Thickness Tester for Plated Metal Coatings. Howard T. Francis. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 79-83.

Device based on anodic dissolution of a defined area of the plated metal, using the current-time product as a measure of the thickness. Successfully measured coatings include: Sn, Zn, Pb, Cd, Cu, Cr, Ag, Au, and brass on steel; and Sn, Zn, Pb, and Cr on brass or Cu. 30 microinches of Sn on steel can be measured with an accuracy of ±2%. (To be presented at meeting of the Society, Columbus, Ohio, April 14-17, 1948.)

8-87. The Electrochemistry of Indium. Therald Moeller and B. S. Hopkins. *Journal of the Electrochemical Society,* v. 93, March 1948, p. 84-93.

A review. Includes electrical characteristics and electrodeposition of the metal; and electrochemical properties of indium compounds. 71 ref.

8-88. Process Sheet for Anodizing Aluminum; Chromic Acid Method. *American Machinist,* v. 92, March 25, 1948, p. 133.

Recommended procedures.

8-89. Process Sheet for Decorative Nickel Plating. *American Machinist,* v. 92, March 25, 1948, p. 137.

Recommended procedures.

8-90. Production Electroforming. Thomas S. Blair. *Iron Age,* v. 161, April 1, 1948, p. 72-75.

Installation is electroforming over 40,000 small articles a week. Precision of the pieces and ability of the process to form intricate shapes or articles of high design prove to be the outstanding advantages. Electrodeposition on plastics and electropolishing operations are also touched upon.

8-91. The Anodic Behavior of Metals. Part III.—Nickel. A. Hickling and J. E. Spice. *Transactions of the Faraday Society,* v. 43, Nov.-Dec. 1947, p. 762-769.

The initial buildup of anodic polarization at a nickel anode over a wide range of conditions was investigated, using the cathode-ray oscillograph. In alkaline solutions (pH 12 to 14), two main stages were distinguished corresponding to the charging of a double layer and the deposition of oxygen at the electrode. It is believed that the latter process corresponds to formation of a layer of nickelic oxide. In buffer solutions (pH 5 to 10), a nickel anode may become passive by the primary formation of a sparingly soluble salt film; this may be followed by oxide formation if the film is porous. In more acid solutions, behavior depends upon the presence or absence of a protective film. 20 ref.

8-92. Deposition of Metals From Their Chloride Solutions. (In Russian.) D. M. Chizhikov and B. Ya. Tratsevitskaya. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1653-1661.

Results of a study for Zn, Fe, Sn, Pb, and Cu, including effects of various factors.

8-93. Kinetics of Deposition of Cobalt and Nickel From Aqueous Solutions by Metallic Zinc. (In Russian.) G. S. Frents and B. P. Kreingauz. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1705-1712.

Experimental results show that deposition takes place most efficiently at a pH of 3.5 to 4.0 The process of deposition proceeds more rapidly at higher concentrations of metal in solution. Co is deposited twice as fast as Ni for the same conditions.

8-94. Electroforming and Deposition Brings New Latitude to the Designer. *Inco,* v. 22, Spring 1948, p. 12-13.

Complicated shapes impossible to produce economically by other fabricating methods as well as deposition of metal on a plastic base are made possible on a production basis.

8-95. Hard Nickel Electroformed Molds; Position Reviewed After Four Years. P. Spiro. *Plastics,* (London), v. 12, March 1948, p. 132-136.

Refers to article in May 1944 issue: "A New Process for Making Molds by Electrodeposition", and outlines results of four more years of development work.

8-96. Industrial Electrodeposition; Quality of Adhesion—Testing of Deposits. R. E. Wilson. *Metal Industry,* v. 72, March 12, 1948, p. 211-213; March 26, 1948, p. 251-254.

Methods of obtaining complete bonding and adequate protection against corrosion with emphasis on deposition of Ni and Cr on steel. Applications to salvage of heavy parts and equipment.

8-97. Streamlined Analytical Control of Gold-Alloy Plating Solutions. Karl Nell. *Plating,* v. 35, April 1948, p. 345-350.

Stepwise colorimetric procedure developed as a result of experimentation for Au, Ni, Cu, and phosphate ion, which may be applied to a single sample (5 to 10cc.) of plating solution.

8-98. A Silver Recovery Plant Before and After. *Plating,* v. 35, April 1948, p. 354-357.

Revolutionary changes in plant of silverware manufacturers by which a dilapidated, crowded, ill-ventilated and dirty shop was transformed into a spacious, spic-and-span,pleasant place to work.

8-99. Ultra-Modern Plating Setups Employed at G. E. Plant. Herbert Chase. *Products Finishing,* v. 12, April 1948, p. 24-26, 28, 30, 32.

New plant manufacturing "all-automatic" washer which utilizes latest equipment and processes for cleaning and applying bright-zinc and hard-chromium coatings to steel parts.

8-100. Plating on Aluminum. *Electroplating,* v. 1, April 1948, p. 271-273.

Process just patented in England by a Swiss concern. Copper is first deposited on a cleaned and partially deoxidized aluminum surface. Hydrogen liberated during the coppering operation is believed to reduce all remaining oxide so that the metal surface, stripped of copper by an acid mixture, is then suitable for plating. Nickel is then deposited, followed by zinc or cadmium and other metals if required. It is essential that the metal deposited over the original nickel plate should have a crystal structure different from that of the nickel, in order to reduce porosity.

8-101. Transmission of Cracks From Plate to Underlying Metal. F. D. Rowe and J. B. Dance. *Metal Progress,* v. 53, April 1948, p. 537-538.

An example of fatigue failure of an exhaust-valve stem overlaid with chromium. Pre-existing stress cracks in the plating are linked with fatigue cracks in the base metal. The authors conclude that hard chromium is an unsatisfactory coating for components operating under fluctuating stresses.

8-102. Corronizing Processes. *Wire and Wire Products,* v. 23, April 1948, p. 311, 343-348.

Use of nickel-zinc and nickel-tin in the protection of steel articles against corrosion.

8-103. The Production of Electroformed Molds. P. Spiro. *British Plastics,* v. 20, March 1948, p. 124-129; **The Production of Electroformed Molds for Plastics and Die Castings** (same author) *Electroplating,* v. 1, April 1948, p. 256-262; discussion, p. 262-266.

The process; type of mold, the master material, metalizing of the master, and selection of the metal for deposition. Choice was among Ni, Fe, Co, and Cr. All but the first were ruled out on various grounds. Composition of the bath; adhesion, pitting, and stress problems; alternative baths; throwing power; hardness and ductility of the deposit; corner weakness; backing and polishing the shells; and analysis for traces of cobalt. 11 ref. (Presented at meeting of Electrodepositors' Technical Society, London, Feb. 16, 1948.)

8-104. Electropolishing—A Survey. (Conclusion.) Samuel Wein. *Metal Finishing,* v. 46, April 1948, p. 76-82.

Applications and limitations of the process from the practical standpoint, and the different baths used.

8-105. Economical Rinse Tank Design. J. B. Mohler. *Iron Age,* v. 161, April 15, 1948, p. 76-77, 140.

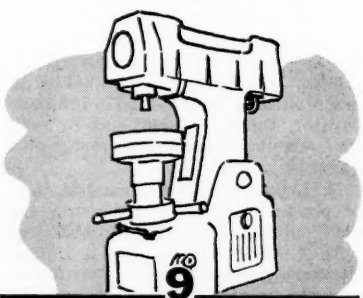
Tanks used in electroplating and in other processes where rinsing operations are carried out. Principles of design for both single and multiple-tank systems and methods for checking and controlling rinsing efficiency. Sample calculations for determination of tank design and most economical water flow.

8-106. Vinyl Plastics for Masking in Electroplating. *Iron Age,* v. 161, April 15, 1948, p. 94.

Resulted in specific operation improvements.

For additional annotations indexed in other sections, see:

7a-86-90; 7b-50; 7c-13; 7d-12; 11-72; 27a-55



PHYSICAL and MECHANICAL TESTING

9a—General

9a-28. Abrasion Testing of Anodized Coatings. Arthur P. Schulze. *Products Finishing,* v. 12, March 1948, p. 66, 68, 70, 72.

Use of instrument known as the Taber Abraser.

9a-29. Methods of Testing Metallic Abrasives. J. E. Hurst. *Metallurgia,* v. 37, Feb. 1948, p. 205-210.

Previously abstracted from *Iron and Steel,* v. 21, Jan. 1948, p. 18-22. See item 9a-12, R.M.L., 1948.

(*Turn to page* 26)

Surface Measurement Evolves From Delicate Lab Apparatus to Rugged Plant Instrument

Reported by M. R. Hyslop

Rugged and compact equipment for measuring surface irregularities in units only a fraction of the diameter of a human hair represents the fruit of some 20 years' experimentation, study and improvements, said Ernest J. Abbott, president of Physicists Research Co., in an interview during the Tool Engineers Industrial Exposition held in Cleveland in March.

E. J. Abbott

Mr. Abbott told how experiments in surface roughness measurements were undertaken almost simultaneously both in Germany and at the University of Michigan, where he was then a research physicist. The early instruments—based on the deflection of a light beam actuated by a diamond tracer point and reflected by mirrors onto photographic paper—were delicate pieces of laboratory apparatus, limited in range to a fraction of an inch of surface measurement.

Undiscouraged by the fact that the results of many an early experiment were ruined by the footstep of an uninitiated intruder across the laboratory floor, Mr. Abbott set to work to devise an instrument that could be taken into the plant for practical and production inspection purposes. He likes to recall the early days when automobile owners, at every stop for gasoline, automatically added, "and put in a quart of oil," all in one breath. Cylinders at that time were finished by relatively crude methods, and it took a surface profile record to prove the advisability of changing to a honed finish—saving subsequent autoists untold millions of quarts of oil!

Today's Profilometers—and particularly the Proficorder, a new refinement—are vastly different from the first delicate instruments put on the market. The Proficorder is a mechanical-electronic robot that will automatically record waviness in the surface as well as the more closely spaced irregularities that constitute roughness. Another trick it will do is take a perpendicular step, as Mr. Abbott demonstrated by running the tracer over a series of three gage blocks varying slightly in thickness.

The business end of the Proficorder is a compact piloting fixture carrying the diamond tracer. Vertical movement of the tracer point over the surface generates a minute electrical voltage (on the order of one-millionth volt for one - millionth inch of movement). The piloting fixture is wired to an "amplicorder", which amplifies the voltage and drives the recording pen.

The amplicorder is about the size of a tea wagon and similarly equipped with casters; its insides hold the necessary electron tubes, and its table top carries a few adjusting knobs on one side, and on the other feeds out a continuous 4¾-in. wide strip of chart paper bearing a magnified pen trace of the shape, height and spacing of surface irregularities. While the vertical dimensions may be magnified 500 to 10.000 times, yards of awkward paper strip are saved by holding horizontal dimensions to 1 to 200X; both of these ratios are adjustable by the turn of a knob. Speed of travel of the tracer is likewise variable.

Piloting fixtures of various types are available. The standard general-purpose head is mounted on a table top for working with small and movable parts. Other fixtures have been designed for large, stationary parts.

One of the most ingenious and interesting of these is a portable fixture 13 in. long, and roughly cylindrical in shape so that it fits in the palm of the hand; it weighs about 12 lb. It is used for profiling axially the inside cylinder bores of large engines, and is rugged enough even to be taken to the repair shop for inspecting a locomotive engine in process of overhaul. Length of stroke of the tracer point is a record-breaking 2½ in., soon, according to Mr. Abbott, to be surpassed by an instrument now in the design stage that will make a trace 8 in. long.

The Proficorder, Equipped With General-Purpose Piloting Fixture

Apologies!

With humility and embarrassment the editors wish to call attention to an unfortunate error on page 27 of the April issue of *Metals Review*. Mr. DeLong, who was tendered the Bradley Stoughton Award of the Lehigh Valley Chapter, is not president of Bethlehem Steel Co., but vice-president of Carpenter Steel Co. Our sincere apologies to both Mr. DeLong and Mr R. T. Saeger, whose report was correctly submitted but garbled in the print shop.

9b—Ferrous

9b-19. Torsional Fatigue of Marine-Engine Shafting. *Engineering,* v. 165, March 5, 1948, p. 229-230.

Reviews and discusses "Large Scale Torsional Fatigue Testing of Marine Shafting", by S. F. Dorey, presented at meeting of Applied Mechanics Group, Institution of Mechanical Engineers, Feb. 13, 1948. The experimental procedure consisted of subjecting the shafts to a succession of 10 million stress cycles at regular increments of stress until failure occurred.

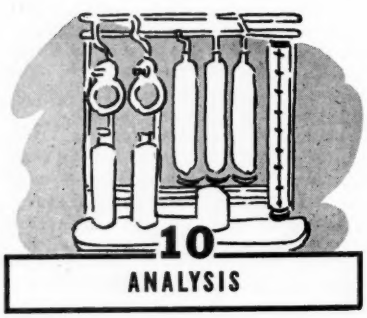
9b-20. Large-Scale Torsional Fatigue Testing of Marine Shafting. S. F. Dorey. *Engineer,* v. 185, Feb. 20, 1948, p. 183-185; discussion, p. 188-189. A condensation.

Previously abstracted from *Engineering,* v. 165, March 19, 1948, p. 286-288; March 26, 1948, p. 310-312. See item 9b-19, R.M.L., 1948. (Presented at meeting of Institution of Mechanical Engineers, Feb. 13, 1948.)

9b-21. Torsional-Fatigue Testing of Marine Shafting. S. F. Dorey. *Engineering,* v. 165, March 19, 1948, p. 286-288; March 26, 1948, p. 310-312.

Experimental procedure and results obtained. The method consisted of subjecting the shafts to a large number of stress cycles until failure occurred. This usually took place around 10,000,000 cycles.

For additional annotations indexed in other sections, see:
3b-46-47.



10
ANALYSIS

10a—General

10a-30. Méthode Pratique de Dosage Amperométrique du Manganese. (Practical Method for Amperometric Determination of Manganese.) G. Goffart, G. Michel, and Th. Pitance. *Analytica Chimica Acta,* v. 1, Dec. 1947, p. 393-407.

The manganous ion is oxidized quantitatively into the manganic by titration with permanganate in approximately neutral pyrophosphate solution. The end point is obtained electrometrically. There is practically no foreign-ion interference.

10a-31. Simultaneous Photography of Two Wave-Length Ranges in Spectrochemical Analysis. N. H. Nachtrieb and others. *Ananlytical Chemistry,* v. 20, March 1948, p. 282.

Modification of an A.R.L.-Dietert spectrograph so as to direct light from one arc or spark source upon two of the slits at one time, which is useful in analysis of certain materials in which the important lines are widely separated.

10a-32. Experience With Photometric Procedures for the Determination of Metals. H. Cox. *Metallurgia,* v. 37, March 1948, p. 270-274.

Various problems associated with the use of photometric procedures and suggested improvements. A method for the determination of Cr in steel eliminating the use of silver nitrate as a catalyst, and a composite method for determinations of Cr, Mo, Fe in welding fluxes. 18 ref.

10a-33. 45-Second Spectrochemical Analysis of Metals Possible by Direct-Reading Method. *Steel,* v. 122, April 12, 1948, p. 109, 112, 114.

The "Quantometer", an instrument by which up to 11 elements can be analyzed simultaneously.

10b—Ferrous (Base Metal)

10b-21. Contribution au Dosage du Vanadium dans les Aciers et les Ferrovanadium. (Contribution to the Determination of Vanadium in Steels and Ferrovanadium Alloys.) Robert Lannet. *Revue de Métallurgie,* v. 44, July-Aug. 1947, p. 210-220.

After examining potentiometric and oxidation-reduction methods, the author concluded that the use of phosphoric acid is the simplest method has some advantages. 11 ref. mination of vanadium alone. For successive determinations of Mn, Cr, and V, the electrotitrimetric method has some advantages. 11 ref.

10b-22. Quantitative Spectrochemical Analysis of Steel. (In English). J. Gillis and J. Eeckhout. *Analytica Chimica Acta,* v. 1, Dec. 1947, p. 377-389.

Operating conditions for the spectrochemical analysis of iron and carbon-steel, using solutions, which are said to result in more satisfactory results than solid electrodes. Investigation was carried out with a Hilger medium spectrograph. Analysis lines and tables are given for determination of the contents of Ni, Mn, Cr, Co, Ti, Al, Mo, V, Zr, As, Cu, Nb, and Ta. 24 ref.

10b-23. Hydrogen, Nitrogen and Oxygen in Ferrous Metals; Their Properties and Their Determination—Parts IV and V. E. C. Pigott. *Metallurgia,* v. 37, Feb. 1948, p. 181-184; March 1948, p. 263-266.

Details of methods for oxygen determination. (To be continued.)

10b-24. A Critical Examination of a Perchloric Acid Colorimetric Method of Analysis for Chromium in Carbon and Low Alloy Steel: Report of the Methods of Analysis Committee of the Metallurgy Division of the British Iron and Steel Research Assoc. *Metallurgia,* v. 37, Feb. 1948, p. 211-216.

The method is very simple and rapid, but several factors exert a marked effect on the color intensity of the solution and it is not considered suitable as a standard method. Under routine conditions, however, the method has obvious advantages.

10b-25. Determination of Silicate Inclusions in Steel. J. Kamecki and A. Kotlinski. *Nature,* v. 161, March 13, 1948, p. 402.

Procedure using dissolution in acetic acid. Comparison with accepted methods gives satisfactory results. Use for determination of Al_2O_3 in steel was also satisfactory.

10c—Nonferrous (Base Metal)

10c-19. Determination of Oxygen by the Vacuum Fusion Method. C. N. Rice. *U. S. Atomic Energy Commission,* MDDC-356; LADC-143, Oct. 5, 1944. 6 pages.

Changes made in the vacuum fusion method for oxygen determination. As a result of these changes it is possible to complete analyses of six uranium-metal samples in a 15-hour period.

10c-20. Analytical Chemistry of the Manhattan Project; Vanadium, Columbium, and Tantalum. S. W. Rasmussen and C. J. Rodden. *U. S. Atomic Energy Commission,* MDDC-373, Sept. 30, 1946, 8 pages.

Colormetric, gravimetric, and volumetric methods of determination and separation. 36 ref.

10c-21. L'Ortho-Oxy-Phenylfluorone, Réactif Spécifique Soit du Molybdene, Soit du Cuivre. (Ortho-Oxyphenylfluorone—A Specific Reagent for Both Molybdenum and Copper.) J. Gillis, A. Claeys, and J. Hoste. *Analytica Chimica Acta,* v. 1, Dec. 1947, p. 421-428.

Details of filter-paper qualitative method.

10c-22. Spectrochemical Determination of Nickel in Electrolytic Cobalt Using a Current-Regulated Direct-Current Arc. Clyde A. Bridger and Graham W. Marks. *Bureau of Mines, Report of Investigations* No. 4198, Feb. 1948, 7 pages.

Apparatus and methods used. 10 ref.

10c-23. A New Dry Test for Gold. R. C. Mehrotra. *Nature,* v. 161, Feb. 28, 1948, p. 321.

Gold salt in concentrated HCl was heated with a trace of metallic zinc in a porcelain dish. On dipping a test tube full of water in the solution then holding in the Bunsen flame, a green mantle forms. Sn and Cu interfere, but Hg, Pb, Ag, and Pt do not.

10c-24. Analysis of Cemented Carbide Compositions. W. O. Touchy and John C. Redmond. *Analytical Chemistry,* v. 20, March 1948, p. 202-206.

Procedure for complete analysis. Classical methods and published procedures leave much to be desired. The method is said to be more rapid and is shown to give good agreement on known mixtures. Procedures are also given for determination of individual elements.

10c-25. Analysis of Thorium-Chromium Mixtures. Richard E. Ewing and Charles V. Banks. *Analytical Chemistry,* v. 20, March 1948, p. 233-235.

Method described involves perchloric acid oxidation of Cr in the presence of Th, followed by titration with ferrous sulphate and tetrasulphatoceric acid. The Th is precipitated as the oxalate and determined gravimetrically after removal of the Cr as chromyl chloride. 12 ref.

10c-26. Potentiometric Determination of Lead. Ladislaus Farkas and Norbert Uri. *Analytical Chemistry,* v. 20, March 1948, p. 236-237.

Determination by titration with alkali fluoride in the presence of alkali chloride (or bromide) is proposed. Equivalence point is determined by a drop in the ferric-ferrous oxidation-reduction potential.

10c-27. Colorimetric Determination of Traces of Gold. E. B. Sandell. *Analytical Chemistry,* v. 20, March 15, 1948, p. 253-256.

Trace quantities can be isolated by precipitation with stannous chloride, with Te as collector, and determined colorimetrically or photometrically with p-diethylaminobenzylidenerhodanine as reagent. As little as 0.1 parts per million can be determined when a 1-g. sample is taken. Large amounts of Fe, Cu, Pb, and As do not interfere.

10c-28. Determination of Silver With Ascorbic Acid. E. C. Stathis. *Analytical Chemistry,* v. 20, March 1943, p. 271.

Gravimetric method. Pb, Cu, Bi, Cd, Ni, and Zn show no interference. Satisfactory results have been obtained on Ag-Cu coin alloys.

(*Turn to page* 28)

Metallurgist-Designer Must Be Versed In Steelmaking and Stress Problems

Reported by R. W. May
Director, Mechanical Development Dept. Collins Radio Co.

By way of introduction to an address on "Metallurgical Factors in Design", Harry McQuaid, consulting engineer, stressed the metallurgist's position in industry and pointed out that in many instances the metallurgist still hasn't made his value known to management. Mr. McQuaid addressed the Cedar Rapids Chapter A.S.M. on March 9.

Metallurgy as a science was first recognized in the early 1900's, he continued. Timken Roller Bearing Co. was probably one of the first to recognize the need for a metallurgist. The common ground of the metallurgist and the designing engineer was discussed at length.

The object of metallurgists in design is to use the most economical steel possible, and therefore a knowledge of steelmaking is most important. This includes a knowledge of the economics of steelmaking and working. A knowledge of the processing and manufacturing of the parts is also fundamentally important, since oftentimes the service stresses on parts are less than the processing stresses. Mr. McQuaid pointed out that frequently the metallurgist is called upon to correct a poor design just because metallurgy was an easy out for the designer. Among other subjects that must be well known to a metallurgist-designer are stress analysis and stress distribution.

Lubrication, Mr. McQuaid explained, does the job of keeping two metals apart and thereby stopping the microscopic welding which causes the failure of bearing surfaces. In particularly difficult gear problems, copper plating of the parts, as well as use of a sulphur chloride lard oil, will prevent the scoring of bearing surfaces in the initial run-in period.

The important part which scrap and pig iron prices play in determining steel costs was pointed out in connection with a discussion of steel specifications. These specifications should be as broad as possible. Mr. McQuaid predicted that the future trend in steelmaking will be toward the use of small electric furnaces by many small manufacturers to make their own steel. This will come about largely because the cost of electric furnace steel is gradually dropping below that of openhearth steel.

One of the latest developments discussed by Mr. McQuaid has to do with the value of sulphur in steel, which represents a complete revision in earlier thinking. It is now realized that sulphur can be very helpful in controlling grain size and improving machinability. However, if the steel is to be used for welding, sulphur (along with hydrogen) must still be kept low. The use of alloys should be largely restricted to applications requiring high hardenability.

After a brief discussion of the transformation diagram, Mr. McQuaid pointed out that one of the pitfalls in heat treatment of steel is the possibility of hitting the nose of the S-curve during the quench. This frequently gives a mixture of hard crystalline structure with soft grain boundaries; the steel will have high Rockwell hardness but will not have the desired physicals.

Proper grain size should be watched carefully in heat treating, the speaker warned, since it governs impact strength of certain materials. Equally important to grain size are the type and distribution of carbides and sulphides.

Yield Point of Cold Drawn Bars Can Be Controlled

Reported by Knox A. Powell
Research Engineer Minneapolis-Moline Power Implement Co.

The yield point of cold drawn steels can be increased to the equivalent of heat treated materials, within certain limitations, asserted Elbert A. Hoffman, addressing the February meeting of the North West Chapter A.S.M. This can be accomplished by controlling the mechanical work of cold drawing, in combination with stress-relieving treatments. Mr. Hoffman, who is on the metallurgical staff of the LaSalle Steel Co., spoke on "Cold Finished Bars to Physical Property Specifications".

The increase in yield point is roughly proportional to the deformation, he said. Larger sizes of cold finished bars that cannot be drawn, but are merely surface machined, retain the exact properties of the parent hot rolled metal. Intermediate sizes derive intermediate properties from intermediate drawing.

The size and surface finish of cold finished bars can be held to close tolerances, particularly when the bar is centerless ground. Also, the machinability of drawn and stress-relieved bar is generally appreciably better than of bar heat treated to the same physical properties. These are, of course, important matters in shop economy.

Mr. Hoffman's talk was illustrated with slides showing the equipment and the mill operations for cold finishing, and tables showing the variation of properties.

Compliments

To F. L. LAQUE, in charge of the corrosion engineering section, development and research division, International Nickel Co., on his election as president of the National Association of Corrosion Engineers.

♦ ♦ ♦

To ROBERT F. MEHL, head of the department of metallurgical engineering at Carnegie Institute of Technology, on his selection to deliver the Hatfield Memorial Lecture before the May annual meeting of the British Iron and Steel Institute. Dr. Mehl's subject will be "The Decomposition of Austenite by Nucleation and Growth Processes." While abroad, he will also speak before the Swedish Metallographers' Society and the Royal Institute of Technology in Stockholm, Sweden.

♦ ♦ ♦

To HARRY A. SCHWARTZ, director of research for National Malleable and Steel Castings Co., on being invited to address the Institute of British Foundrymen in June. Dr. Schwartz's lecture on "Solved and Unsolved Problems in the Metallurgy of Blackheart Malleable" will be the tenth in the Edward Williams series of addresses delivered at the annual conference of the Institute.

Partnership Formed for Salt Bath and Furnace Sales

Alex F. Blackwood, who for the past 12 years was metallurgical sales engineer for the A. F. Holden Co., has recently resigned and has formed a partnership with J. W. Frazier, formerly metallurgical engineer for Precision Industries, Inc.

Mr. Blackwood and Mr. Frazier will have offices in Cleveland and will serve as consultants and metallurgical sales engineers for the Crown Chemical Corp., John Ek Industries, Inc., and Upton Electric Furnace Division of Commerce Pattern Foundry & Machine Co. in Ohio, West Virginia, Kentucky and Western Pennsylvania. These firms are specialists in the manufacture of quality heat treating salts, conveyerized heat treating units, and salt bath furnaces.

Lindberg Adds Electronics Div.

Lindberg Engineering Co., Chicago, manufacturers of industrial heat treating and melting furnaces, has acquired the assets of the electronics division of Illinois Tool Works, Chicago, an organization engaged in the manufacture and sale of high-frequency induction and dielectric heating equipment. Operations will continue at the Illinois Tool Works plant until June 1, and then move into the Lindberg plant.

10c-29. Electrolytic and Polarographic Determination of Zinc in Thorium. James H. Patterson and Charles V. Banks. *U. S. Atomic Energy Commission,* MDDC-1708, Dec. 29, 1947, 13 pages.

Methods applicable to concentrations from 20 parts per million to 100% Zn. An electrolytic method is used for alloys that contain more than 1% Zn. For less than 1%, a polarographic method is used.

10c-30. Determination of Vanadium in Manganese Ore. Alfred Kundert. *Chemist Analyst,* v. 37, March 1948, p. 16-17.

A method for the separation of vanadium from solution. It was found that a complete precipitation was made by zinc oxide in the presence of sufficient iron to occlude the vanadium. When the iron content was at least twice that of the vanadium, no boiling was required.

10d—Light Metals

10d-9. A New Colorimetric Method for Determining Traces of Beryllium. A. L. Underwood. *U. S. Atomic Energy Commission,* MDDC-1569, Sept. 1, 1947, 12 pages.

Colorimetric method for amounts of 0.2 to 8 micrograms. Effects of pH, dye concentration, time of standing, heating, and several common ions. Accuracy is quite satisfactory.

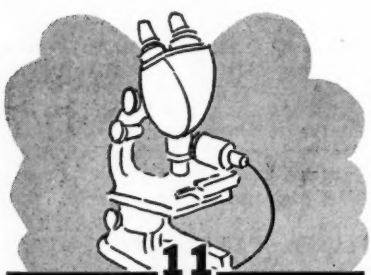
10d-10. A Study of the Reaction Between Beryllium and Aurin Tricarboxylic Acid. George E. Kosel and William F. Neuman. *U. S. Atomic Energy Commission,* MDDC-1665, Jan. 29, 1948, 13 pages.

Reaction was studied spectrophotometrically. From these studies, a procedure was developed for the determination of beryllium in 1 to 10 microgram amounts.

10d-11. Determination of Aluminum in Nitralloy G. Louis Silverman. *Chemist Analyst,* v. 37, March 1948, p. 11, 14.

A previous paper by the author described a convenient method in which Al was separated from Cr and from Fe by use of 8-hydroxyquinoline. It is now shown that Cr may be volatilized as CrO_2Cl_2, thus reducing the time of operation considerably. Further, in the separation of Fe from Al, citric acid but not tartaric acid may be used.

For additional annotations indexed in other sections, see:
7b-49; 8-78; 27b-20.



11
APPARATUS, INSTRUMENTS and METHODS

11-62. Uber Die Möglichkeit der Abbildung von Atomen im Elektronenmikroskop III. Kontraste von Kristallgittern und Elektronenmikroskopisches Phasenkontrastverfahren. (The Possibility of Resolving Atoms in the Type III Electron Microscope. Comparison of the Crystal-Lattice and the Electron-Microscope. Contrast Processes.) H. Boersch. *Monatshefte fur Chemie,* v. 78, no. 1-2, 1948, p. 163-171.

Experimental results indicate that mono-atomic crystalline and amorphous layers of atoms of the higher order of magnitude are discernible and also that individual atoms in a crystal may become recognizable with a slight improvement of present resolving power. Further research is planned.

11-63. Standardization of Buffing for Preparation of Atmosphere Exposure Test Panels. C. C. Cupps and A. K. Graham. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 276-279; discussion, p. 280.

Development of an automatic machine for buffing flat 4 x 6 in. panels which gives greater uniformity and may prove of value for comparison of buffability of plated coatings.

11-64. A Process for the Production of Iron-Free Alum. Part I.—Laboratory Development. Edwin A. Gee and W. K. Cunningham. *Bureau of Mines, Report of Investigations* No. 4191, Feb. 1948, 27 pages.

Investigation of processes for extraction of alumina from low-grade bauxites and clays.

11-65. The Study of Segregations and Inclusions in Steel by Microradiography. W. Betteridge and R. S. Sharpe. *Journal of the Iron and Steel Institute,* v. 158, Feb. 1948, p. 185-191.

Technique is described in detail, including a simple mechanical method for preparation of the necessary thin samples. Tables of linear absorption coefficients for different characteristic radiations are included to facilitate the identification of different segregates and inclusions. Examples of application to the study of steels and conclusions concerning effects of different factors on segregations and inclusions. 12 ref.

11-66. The Measurement of Paint Film Thickness on Mild Steel. F. Fancutt and J. C. Hudson. *Paint Technology,* v. 13, Feb. 1948, p. 49-57.

Experiences with two methods; the A.R.D. Thickness Tester and the Electromagnetic Thickness Meter of the Dutch Corrosion Committee. In the absence of disturbing factors, both instruments are capable of giving reproducible readings of paint-film thickness with ±10% accuracy. The A.R.D. instrument said to be simpler, more robust, and more suitable for general industrial use. Complications arise when either the material within the paint film or immediately beneath it has magnetic properties. The values observed are also affected by the roughness of the surface of the paint film or of the mild steel to which it is applied, by differences in composition of the steel base and, in the case of certain painting schemes, by softness of the paint film itself.

11-67. Refraction Effects in Electron Diffraction and in Electron Microscopy. H. Raether. *Nature,* v. 161, Feb. 28, 1948, p. 311.

Some recent work which indicates that fine structure of electron diffraction patterns of crystals of magnesium oxide, cadmium oxide, and others, results from refraction at the faces of the regularly shaped crystal cubes. This phenomenon is treated mathematically and it is suggested that it may also be of importance in electron microscopy.

11-68. Surface Radiography With Alpha Rays. C. Jech. *Nature,* v. 161, Feb. 28, 1948, p. 314.

The short lived atoms of radium A, B, C, and C' are deposited on the surfaces of objects which come in contact with radon. Three of them emit alpha rays. The emulsion of a photographic plate is blackened by these particles. The geometric properties of the surface cause a different blackening due to the alpha emission of the deposit on the surface. A radiographic method which shows the structure of the surface was developed on the basis of this phenomenon.

11-69. Comparison of Metallographic and X-Ray Measurements of Retained Austenite. William J. Harris, Jr. *Nature,* v. 161, Feb. 28, 1948, p. 315-316.

Addition of a mixture of high-molecular-weight alkyl dimethyl benzyl ammonium chlorides known as "Zephiran Chloride" to a solution of nitric acid in alcohol was found to result in metallographic measurements practically identical to X-ray measurements, although reproducibility of the latter was better.

11-70. Thickness Testing of Paint and Metal Coatings on Steel. Donovan H. Lee. *Sheet Metal Industries,* v. 25, March 1948, p. 555.

Magnetic thickness tester and its use.

11-71. On the Investigation of Specimen Contamination in the Electron Microscope. James Hillier. *Journal of Applied Physics,* v. 19, March 1948, p. 226-230.

Results of a series of experiments indicate that contamination is a result of chemical reaction, occurring at any surface simultaneously bombarded by electrons and organic molecules. The organic vapors are shown to arise in two ways: by diffusion out of metal walls, gaskets, and greases exposed to the vacuum, and by outgassing of metal parts of the instrument. (Presented at 1946 meeting of Electron Microscope Society of America, Pittsburgh.)

11-72. Ferrous Alloys; Investigation of Electrolytic Etching Solutions. W. I. Pumphrey. *Iron and Steel,* v. 21, March 1948, p. 75-80.

Results of a study of a number of potentially suitable solutions for electrolytic etching of ferrous alloys and the effect of each electrolyte on a number of different materials ranging from cast iron to high-alloy stainless steel. The nature of electrolytic etching.

11-73. Recording Crevices in Plane Surfaces by Pigment-Fillings Held in Cellulose Acetate Molds. A. T. J. Dollar. *Nature,* v. 161, March 6, 1948, p. 358.

New procedure useful for etched or abraded plane surfaces of rocks, minerals, and metals.

11-74. Photometric Measurement of Specific Surface. B. A. Scott. *Nature,* v. 161, March 6, 1948, p. 358-359.

In the course of measurements of the light transmission of dispersions of fine alumina powder in aqueous media, it was found that effective projected area per unit weight of powder gives a fairly good straight line when plotted against the 4th power of the wave-length of the incident light. This method, which is rapid and economical of sample material, is capable of giving a good estimate of the specific surface of alumina powders over a wide range of values (1000 to 40,000 sq. cm. per g.), and may find application to other transparent crystalline materials.

11-75. Fractography; The Study of Fractures at High Magnification. C. A. Zapffe, F. K. Landgraf, Jr., and C.

(*Turn to page* 30)

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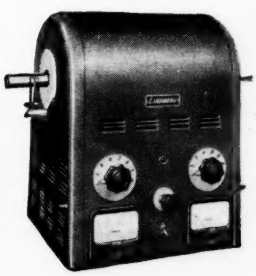

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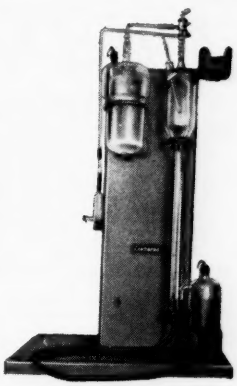

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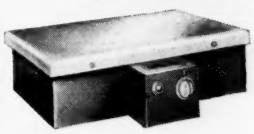

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O. Worden, Jr. *Iron Age,* v. 161, April, 1948, p. 76-82.

Principal features and application of fractography to the study of various ferrous and nonferrous metals, including Zn, Bi, Fe-Si alloys, Fe-Cr alloys and Mo. Of particular interest is the association of certain features, visible in the fractographs, with physical properties and characteristics of the metals involved.

11-76. Sharp-Focusing X-Ray Tube for Structural Analysis. (In Russian.) V. D. Bezverkhii and B. Ya. Pines. *Zhurnal Tekhnickeskoi Fiziki* (Journal of Technical Physics), v. 17, Nov. 1947, p. 1341-1352.

Construction and operation. Typical results.

11-77. Lead Telluride Cells for Infrared Spectroscopy. O. Simpson, G. B. B. M. Sutherland, and D. E. Blackwell. *Nature,* v. 161, Feb. 21, 1948, p. 281.

Some results which indicate the potentialities of above cells for spectroscopic work, where they are clearly far superior to sulphide and selenide types.

11-78. Worm Gears. *Automobile Engineer,* v. 38, March 1948, p. 117-118.

David Brown Universal worm-gear-testing machine No. 12A.

11-79. The Determination of Equilibrium Diagrams. G. V. Raynor. *Journal of the Birmingham Metallurgical Society,* v. 28, March 1948, p. 3-23; discussion, p. 24-36.

The various methods.

11-80. The Adiabatic Temperature Changes Accompanying Magnetization in Low and Moderate Fields: A Further Study of Iron. L. F. Bates and E. G. Harrison. *Proceedings of the Physical Society,* v. 60, March 1948. p. 225-235; discussion, p. 235-236.

It was found possible to use a commercial instrument in place of a "home-made" fluxmeter with the Bates and Eston method of measuring small changes of temperature. The new instrument was used to make a further study of the small heat changes which accompany step-by-step changes in the magnetization of iron, using the specimen of annealed Armco iron previously studied by Bates and Healey, and a specimen of H. S. electrolytic iron. Heat changes associated with the virgin magnetization curve were obtained for the first time. 12 ref.

11-81. The Measurement of the Permeability of Low-Conductivity Ferromagnetic Materials at Centimeter Wave Lengths. J. B. Birks. *Proceedings of the Physical Society,* v. 60, March 1948, p. 282-292.

A wave guide impedance method for the above measurement which avoids the difficulties and anomalies present in earlier measurements. Apparatus and techniques used at 20 to 60 cm., 6 to 15 cm., 3 cm., and 1¼ cm., and some typical results of measurements on γ-ferric oxide. It is shown that the observed magnetic dispersion is an inherent property of the material, and is not attributable to skin-effect. 16 ref.

11-82. A New Device for Maintaining Constant Stress in a Rod Undergoing Plastic Extension. E. N. da C. Andrade. *Proceedings of the Physical Society,* v. 60, March 1948, p. 304-307.

Simple mechanical device. The midpoint of the wire maintains its position during extension, so that it may be observed by use of a fixed microscope.

11-83. A Rapid X-Ray Method for the Determination of the Orientation of Single Crystals or Large-Grained Polycrystalline Aggregates. A. E. De Barr. *Journal of Scientific Instruments and of Physics in Industry,* v. 25, March 1948, p. 102-104.

A type of goniometer which enables a crystal to be set in a given orientation. The method makes use of strong, high-Bragg-angle reflections on a fluorescent screen. Orientation of any given face is calculated from the readings of two angle scales on the instrument, and is plotted on a stereographic projection.

11-84. Polishing Metallographic Specimens With Diamond Dust. G. C. Woodside and H. H. Blackett. *Industrial Diamond Review,* v. 8, March 1948, p. 92-93. Reprinted from *Metal Progress,* v. 51, June 1947, p. 945-947.

Previously abstracted. See item 11-79, R.M.L., v. 4, 1947.

11-85. Applications of the Angle Dekkor. B. P. Harrold. *Machinery* (London), v. 72, March 25, 1948, p. 391-397.

Simple and sturdy optical instrument used for checking angles in the shop, and its accessories. Various applications.

11-86. Control of Automatic Resistance Heating Machine. M. B. Ladd. *Electrical Manufacturing,* v. 41, April 1948, p. 118-121.

Uniform heating of forging blanks by low-voltage, high-amperage current is closely controlled by phototubes which actuate relays, and through them solenoid valves, hydraulic-clamping contacts, and transformer-input switches. Construction and circuit diagrams.

11-87. Oscillographic Performance Check of an Automatic Cutter Sharpener. Royce E. Johnson and Frank A. Glassow, *Electrical Manufacturing,* v. 41, April 1948, p. 122-124.

Use of a three-element magnetic oscillograph enables electrical, mechanical, and hydraulic functions to be coordinated accurately and results in simplification of the electrical controls of a hob-cutter sharpener.

11-88. Determination of Phase Fields. William L. Fink. *Metal Progress,* v. 53, April 1948, p. 530-535.

Several useful ways for determination of concentration limits at various temperatures.

11-89. New Process Control Instruments for Chemical Industry. Everett S. Lee. *Chemical Engineering Progress,* v. 44, April 1948, p. 263-267; discussion, p. 267-268.

Briefly describes and gives applications of mass-spectrometer-type instruments, thermal gas analyzers, X-ray photometer, dew point recorder, fault detector, and recording spectrophotometer.

For additional annotations indexed in other sections, see: 8-71-81-86.

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12 INSPECTION and STANDARDIZATION

12a—General

12a-37. Decimal Equivalents of Various Gages. *American Machinist,* v. 92, March 25, 1948, p. 135.

12a-38. La Normalisation en Soudure; Soudage par Resistance. (Standardization in Welding; Resistance Welding.) A. Gaubert. *Soudure et Techniques Connexes,* v. 2, Jan-Feb. 1948, p. 34-35.

Tentative definitions and conditions for resistance welding. Comments are requested before May 31, 1948, when they will become official.

12a-39. Radioactive Isotopes as Sources in Industrial Radiography. Gerold H. Tenney. *U. S. Atomic Energy Commission,* MDDC-1690, Jan. 29, 1948, 21 pages.

Elementary principles, and experiments in which radio-lanthanum was used as source of radiation. Characteristic curves for radiography of steel up to a thickness of 5¼ in. were developed.

12a-40. Sigma Electropneumatic Gage. *Machinery* (London), v. 72, Feb. 19, 1948, p. 236.

System for measurement of holes which are inaccessible or too small to permit other mechanical or electrical methods of gaging.

12a-41. Characteristics of Some Nonscreen Films Used in Industrial Radiology. R. L. Durant. *Journal of Scientific Instruments and of Physics in Industry,* v. 25, March 1948, p. 105-110.

In the past, difficulties due to lack of flexibility in control of both contrast and speed of X-ray films have been encountered. Results of investigation show that a much wider range of film speed and contrast can be obtained. In extreme cases speed ratios of 400:1, and contrast ratios of 5:1 are obtainable by modification of the time of development alone. Applications to practical radiography are considered.

12a-42. The Detection of Cracks by X-Rays and Gamma Rays. C. Croxson. *Electronic Engineering,* v. 20, April 1948, p. 106-111.

An illustrated survey. (Based on a lecture given at Symposium on Methods of Crack Detection, Industrial Radiology Group, Institute of Physics, July 1947.)

12a-43. Precision Measurement. Part II. Zeiss Gear-Tooth and Cam Checking Machines; Leitz Drill-Spotting Instrument: Carl Mahr Dial Micrometer. S. C. Poulsen. *Aircraft Production,* v. 10, April 1948, p. 126-129.

12a-44. Producer's Quality Control Report Aids Inspection of Incoming Parts. G. R. Armstrong. *Machinery* v. 54, April 1948, p. 162-165.

Use of frequency-distribution charts.

12a-45. Let the Machine Talk. C. W. Kennedy. *Tool Engineer,* v. 20, April 1948, p. 17-20.

(*Turn to page* 32)

Copper Production Second Only to Steel; Croft Traces It From Mine to User

Reported by Jack W. Hobbs
Rogers Tool & Die Co., Inc.

Beginning with a map of the copper ore deposits throughout the world and figures for copper production, Harry Croft, director of technical control and research of the midwestern division of the Chase Brass & Copper Co., showed the location of smelters, refiners, and fabricators of this metal. Dr. Croft presented a talk on "Copper From Mine to User" to the Akron Chapter of the A.S.M. on March 10. Production of copper is second only to steel in annual tonnage of the metals, he said.

After describing the recovery of copper from its ores, he exhibited slides illustrating the fabrication of copper and its alloys. Recent developments in continuous casting, extrusion of rod and tube, piercing of tube billets, and hot and cold rolling of rod and sheet were included.

Tellurium, added to increase machinability, has certain advantages over the use of lead for the same purpose, according to Dr. Croft. This superiority in the red metals results from the fact that the copper telluride is more resistant to hot shortness than similar alloys which employ lead for improvement of machinability.

Turning to the uses of copper alloy sheets, Dr. Croft illustrated the degree of deformation that is possible in drawing, stamping, and employing metals with various degrees of temper. It is generally assumed that the soft temper is necessary for such operations, but considerable reductions can be effected with cold rolled stock.

In the age hardening alloys, chromium and other elements can be precipitated from solution to produce metals high in strength, hardness and resistance to deformation at elevated temperatures—at the same time maintaining high electrical conductivities.

In the discussion following the presentation, the question of additions of small amounts of metals to prevent dezincification of the yellow brasses was raised. Very small amounts of antimony, phosphorus, or arsenic will render yellow brasses practically immune to failure by this form of corrosion.

The problem of stress-corrosion cracking was also questioned, and the speaker gave four optional preventive methods. First is the use of copper-rich alloys for installations where exposure to corrosive atmospheres is encountered. Second is the use of operations which will set up stresses counter to those in cold worked metal, and thereby reduce the latter to a harmless degree. These include straightening or "reeling" of rods or tubes and the cold working of the surface of fabricated parts by various methods. Third is employment of metal of small grain size wherever possible; and fourth, where conditions are such that none of the above methods can be employed, the low-temperature or stress-relief anneal which reduces internal stresses without reducing the physical properties or otherwise softening the metal.

Speaks on Properties and Performance of Steel

Reported by R. T. Saeger
Bethlehem Steel Co.

"Properties and Performance of Steel" was the subject presented by Harry B. Knowlton, materials engineer for the International Harvester Co., before the April meeting of the Lehigh Valley Chapter A.S.M. The talk was nicely illustrated with slides showing charts and pictures of the performance of several grades of steel in actual service.

This meeting was the final technical session for the current season.

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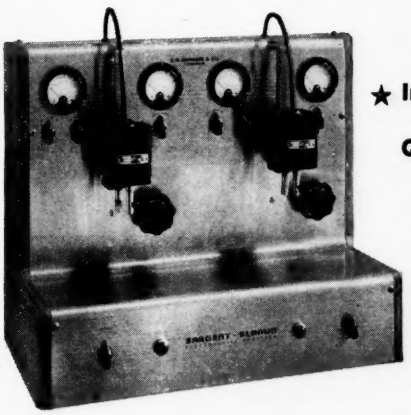

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12a-46. New Standards Set the Pace for Fine-Pitch Gearing. Louis D. Martin. *Electrical Manufacturing,* v. 41, April 1948, p. 80-84, 135.

A review of what has been accomplished and a projection of new developments in standards and equipment for producing this specialized type of gearing, made by the chairman of the A.G.M.A. Fine-Pitch Gearing Committee.

12a-47. X-Ray Thickness Gage for Cold Rolled Strip Steel. W. N. Lundahl. *Electrical Engineering,* v. 67, April 1948, p. 349-353. A condensation.

Details of construction and circuits of an X-ray thickness gage for cold mill and other applications utilizing one photoelectric multiplier pickup and two X-ray sources. Range is 0.005 to 0.050 in. with accuracies up to 1%. (Presented at A.I.E.E. winter general meeting, Pittsburgh, Jan. 26-30, 1948.)

12b—Ferrous

12b-20. Recommended Practices for Staybolt Application and Maintenance. *Master Boiler Makers' Association, Official Proceedings of the 1947 Annual Meeting,* 1947, p. 118-152; discussion, p. 152-165.

A survey of tolerances for taps and staybolts, by G. R. Greenslade; a discussion of inspection gages for screw thread, by W. C. Masters; and the following papers: Boiler Practice and Material Specifications, S. E. Christopherson; Comments Concerning Practice of a Manufacturer Relating to Application of Staybolt in New Boilers, R. J. McNamara; Application and Maintenance of Staybolt, W. H. East; and Following Practices of Staybolt Application, Erie Railroad, S. S. McConnell.

12b-21. Supersonic Pulses Probe Metals to Hunt Flaws, Check Thickness. H. C. Drake and E. W. Moore. *Aviation Week,* v. 48, March 22, 1948, p. 21-23.

Use of above to detect internal defects in high-strength propeller steel and to gage thicknesses accurately.

12b-22. A Comparison of X-Ray and Gamma-Ray Methods for Testing Steel Castings. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 270.

A statement, by the Steel Castings Division of the British Iron and Steel Research Assoc.

12b-23. The Administration of Inspection and Dispatch in a Steel Wire Mill. C. Coates. *Wire and Wire Products,* v. 23, April 1948, p. 307-310, 346-348.

Organization and procedure.

12b-24. Standard Carbon and Free Cutting Steels. *Metal Progress,* v. 53, April 1948, p. 544-B.

A tabulation showing compositions of S.A.E. and A.I.S.I. designations, revised Oct. 30, 1947.

12b-25. Statistical Analysis for Quality Control of Forgings. E. W. Mace. *Steel Processing,* v. 34, April 1948, p. 193-197.

Information presented is mainly connected with drop-forging effects of such factors as depth of dies, die wear, the human element, performance of different machines, and machine maintenance and wear.

12c—Nonferrous

12c-5. What Do You Know About Zyglo? R. O. Schiebel. *Industry and Welding,* v. 21, April 1948, p. 30-32, 36, 56, 58.

A nondestructive inspection method designed for nonmagnetic and nonferrous materials—aluminum, bronze, magnesium, manganese, and stainless steels.

12d—Light Metals

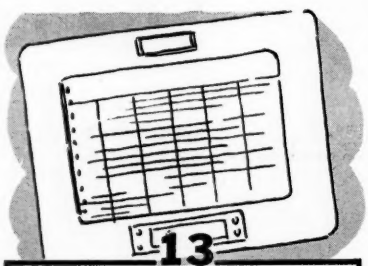
12d-3. The Radiographic Inspection of Jet-Engine Aluminum Alloy Castings. W. A. Mader. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 267-269.

12d-4. Radiographic Appraisal of Spot Welds in Aluminum. Gerard H. Boss. *Metal Progress,* v. 53, April 1948, p. 522-527, 566.

Second portion of a critical resumé of publications concerning wartime work on spot welding.

For additional annotations indexed in other sections, see:

20a-152; 22d-16; 27a-43-50; 27b-24-27; 26c-7.



13

TEMPERATURE MEASUREMENT and CONTROL

13-20. Maintenance of Temperature Indicating and Recording Instruments. Harry C. Morrow. *Iron and Steel Engineer,* v. 25, March 1948, p. 93-96.

Methods used at the sheet and tin mills, Carnegie-Illinois Steel Corp., Gary, Ind.

13-21. Improving Temperature Compensation of Recording Pyrometers. Paul Lincke. *Instruments,* v. 21, March 1948, p. 246.

One of the principal faults of millivoltmeter pyrometers using a bimetallic spiral to compensate for ambient temperature changes is that the compensation is accurate at only one point on the scale. Negative-temperature-coefficient resistance units made it possible to do this in a highly satisfactory manner. By using only a portion of the bimetallic spiral sufficient to shift the open-circuit zero point an amount on the scale or chart equivalent to the change in ambient temperature, and by using a negative-temperature-coefficient resistant unit to compensate at the upper end, excellent compensation is achieved over the entire range.

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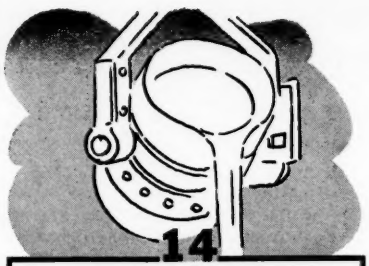


14

FOUNDRY PRACTICE

14a—General

14a-52. Precision Casting. *Engineering Materials and Processes,* v. 5, Dec. 1947, p. 159-161.

14a-53. Modern Foundry Equipment. James F. Driver. *Machinery Lloyd* (Overseas Edition), v. 20, Feb. 28, 1948, p. 79-87.

Sand-testing equipment, analytical reagents, conveyers, shot-blast equipment for cleaning castings, as well as melting furnaces, molding machines, and centrifugal-casting equipment.

14a-54. Produces Wide Variety of Iron and Nonferrous Castings. Gerald E. Stedman. *Foundry,* v. 76, April 1948, p. 92-94.

Products of Paxton-Mitchell Co., Omaha, Neb., include both Fe and Cu-base alloy castings for various uses; and operating practice incorporates both static and centrifugal-casting methods.

14a-55. Foundry Sand Uncontrolled. *Foundry,* v. 76, April 1948, p. 95, 230, 232, 234, 236.

A practical, nonscientific description of foundry-sand troubles and what was done about them at H. C. Macaulay Foundry Co., Berkeley, Calif., a job-shop.

14a-56. Valve Manufacturer Expands Foundry. Joseph C. Sullivan. *Foundry,* v. 76, April 1948, p. 208-210, 212.

New equipment to meet augmented demand for gray iron, brass, bronze, and alloy castings.

14a-57. Molding and Core Sand Control Through Binder Selection. (Concluded.) Earl E. Woodliff. *Pig Iron Rough Notes,* Winter 1948, p. 11-14.

Properties and applicabilities of various binders.

14a-58. Problems in a Quantity Production Foundry. J. Hird. *Foundry Trade Journal,* v. 84, March 11, 1948, p. 243-249; discussion, p. 249-250.

Mechanization, core-sand preparation, mold preparation, casting inspection, and the control laboratory. (Presented at meeting of Wales and Monmouth Branch, Institute of British Foundrymen.)

14a-59. The Use of Fullers' Earth in Foundries. L. V. Roy. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 271-274.

Functions in sand preparation.

14a-60. Adaptable Runner Feeds for Multiple Cavity Dies. W. M. Halliday. *Machinery* (London), v. 72, March 25, 1948, p. 410.

In pressure die casting with a number of cavities, when the amount of metal required exceeds the delivery capacity of the machine, flow to certain cavities must be blocked. Disadvantages of use of detachable sealing pads and an arrangement which overcomes them.

(*Turn to page* 34)

Two Groups of Mechanical Properties Differentiated by Test Methods

Reported by Hans J. Heine
Plant Metallurgist
Pittsburgh Equitable Meter Division
Rockwell Mfg. Co.

Two groups of mechanical properties were differentiated by Richard L. Templin, assistant director of research and chief engineer of tests, Aluminum Co. of America, addressing his home chapter in Pittsburgh on March 11. The first group includes those properties that are standardized and covered by specifications, such as tensile strength, yield strength, elongation and reduction of area. The second group is made up of those properties that are not standardized, such as shear strength, fatigue, formability and elastic constants.

Mr. Templin pointed out that all too often the mode of testing is not indicated, both with respect to the form of the specimen and the apparatus and set-up used; inaccuracies and faulty conclusions are the result. This point was illustrated with a number of slides depicting different shear test specimens and apparatus of considerable variation. The geometry of the test specimen cannot be overemphasized.

Work is now in progress, according to Mr. Templin, toward devising a formability test. So far no satisfactory procedure has been developed, and a workability index is not yet invented.

It has been found that the bend test, although apparently one of the simplest, has a number of variables which may affect the results fundamentally. Close attention to detail is paramount in mechanical testing.

The speaker pointed out that commercial aluminum alloys whose chemical compositions are within specification limits have elastic constants (modulus of elasticity values) which are constant within closer limits than can be determined by the measuring devices and technique normally used in making routine mechanical property tests. For precise determination of these elastic constants the testing machines should be capable of indicating loads within closer limits than those considered satisfactory for routine inspection tests involving tensile s t r e n g t h, yield strength and elongation.

While standard methods obtain for calibrating the loads applied by testing machines yet there are no standard methods for calibrating strainometers. Strainometers may be quite sensitive but this does not necessarily connote accuracy.

The speaker next dealt with some of the factors which affect the accuracy of test results. Shape of the samples, the fixtures used, the personal equation and the testing apparatus are some of the more important ones.

Discussing the significance of mechanical properties, Mr. Templin emphasized that it is not good practice to extrapolate test data to predict service conditions. Mathematics and mechanics, he said, make many assumptions, such as the existence of an isotropic, homogeneous, idealized material in which there are no stress concentrations. However, the avoidance of failures may be aided by applying intelligently the mechanical properties obtained under certain conditions of testing.

In closing, the speaker summarized the use of mechanical testing in industrial applications for routine quality checks, investigations in the search for new processes or materials and the gathering of data for design problems.

In the ensuing lively discussion, which was led by Howard Scott of Westinghouse Research Laboratories, the audience was straightened out on some ambiguously used terms such as proof stress and yield point; the great importance of the size effect was also stressed.

Armco Adopts New Name

The name of the American Rolling Mill Co. has been officially changed to Armco Steel Corp. The new name not only utilizes the company's well-known trade mark, but more fully reflects the true nature and scope of its business.

Welding Considered as Method of Manufacture For Steel Castings

Reported by A. G. Phillips
Staff Metallurgist, Caterpillar Tractor Co.

Welding is not a method of salvaging scrap castings, but a method of manufacturing castings, E. J. Wellauer of the Falk Corp., emphasized in a talk on "Welding Processes in the Manufacture of Steel Castings" before the March meeting of the Peoria Chapter A.S.M.

Welding and steel casting processes are closely related; gas and electricity are the sources of heat for both processes, and both are troubled with the same defects, namely, cracks, slag inculsions, and blowholes. Casting defects can be repaired by welding without impairing, in any way, the usefulness of the casting, if proper care is given to removal of the defect and welding technique.

Ordinary carbon steel castings of less than 0.30% C can be welded without preheat. When preheating is required, maximum benefits are obtained at temperatures between 200 and 300° F. Multiple-pass welding technique will sometimes eliminate the necessity of preheating, since each successive pass anneals the previously deposited metal.

A recent and promising use of steel castings is in the manufacture of composite structures. Steel castings serve as a base or starting point to which plates are welded; costly welding fixtures in the manufacture of many structures such as heavy gear housings are thus eliminated.

Lectures on Welding of Castings

Snapped at Peoria Chapter March Meeting (Left to Right): A. V. Martin of the Peoria Foundry; E. J. Wellauer, Director of Research, Falk Co., the Principal Speaker; T. M. Logan, Peoria Chapter Chairman; and A. W. Johnson of Caterpillar Tractor Co.

14b—Ferrous

14b-36. Elimination of Anneal for Light Gray Iron Castings. R. G. McElwee. *Vancoram Review,* v. 5, no. 3, 1948, p. 19.

Alternative described is use of graphitizing type of inoculant. Addition of a prescribed amount, based on accompanying chart, will serve to eliminate the chilled edge by causing the casting to graphitize to gray iron uniformly throughout the mold. The cost of treatment is claimed to be only a small fraction of the cost of annealing. Also the casting quality should be better because of the uniformity of structure which reduces shrinkage and casting stresses.

14b-37. Canadian Steel Foundry Practice. S. L. Gertsman. *Canadian Mining and Metallurgical Bulletin,* v. 41, March 1948, p. 137-143.

To be presented at annual meeting, Canadian Institute of Mining and Metallurgy, Vancouver, B. C., April 1948.

14b-38. Pioneer Swedish Centrifugal Pipe Foundry. *Foundry Trade Journal,* v. 84, March 4, 1948, p. 219-221.

14b-39. Doubles Foundry Capacity With Same Floor Area. William G. Gude. *Foundry,* v. 76, April 1948, p. 72-77, 118, 120.

Accomplished by Olney Foundry Division, Link-Belt Co., Philadelphia, which produces a wide variety of shapes, sizes, and compositions of gray-iron castings.

14b-40. Desulphurizing With Soda Ash. W. W. Levi. *Foundry,* v. 76, April 1948, p. 78-79, 176, 178, 180, 182, 184, 186.

Use of large percentages of scrap is essential at all times because of economics and obligatory at present because of pig-iron shortage. This results in high sulphur content which is satisfactorily controlled by use of fused soda ash.

14b-41. Molding Sheaves in Dry Sand Cores. William Pink. *Foundry,* v. 76, April 1948, p. 88-89.

Methods for molding 8-ft. diameter cast-iron sheave wheels at Manitoba Bridge & Iron Works Ltd., Winnipeg, Canada.

14b-42. Better Castings for Better Valves Through Mechanization. Charles H. Martin. *Pig Iron Rough Notes,* Winter 1948, p. 22-26.

Procedures and equipment for casting of iron valve parts.

14b-43. Manhole Covers. A. R. Parkes. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 275-276.

Production in a British foundry.

14b-44. A Vent That Was Missed. W. Gudgeon. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 278.

Reason for large percentage of rejects in casting of gas burners.

14b-45. Impurities in Steel Foundry Knockout Sand. H. E. Crivan. *Foundry Trade Journal,* v. 84, March 25, 1948, p. 293-301.

Results of an extensive study of the effect of impurities in sand on the roughness of castings, data resulting from examination and analysis of test castings.

14c—Nonferrous

14c-22. The Development of Foundry Sand Control. G. L. Harbach. *Foundry Trade Journal,* v. 84, Feb. 26, 1948, p. 195-199; March 4, 1948, p. 223-229.

Problems encountered, and their solutions, during development of a method for a mechanized gray-iron foundry. The developments occurred in the following order: "scabbing" of brass-foundry power-rammed molds on account of low sand permeability; study of theory of interlocking of sand grains and its practical application; reduction of losses during casting and knockout; selection of permeable sand suitable for different sizes of castings; and choice of a suitable coal-dust binder. (To be continued.) (Presented at meeting of East Midlands Branch, Lincoln Section, and Wales and Monmouth Branon, Institute of British Foundrymen.)

14c-23. Custom Die-Casting. *Western Machinery and Steel World,* v. 39, March 1948, p. 104-105.

Procedures and equipment used at Merchant Die and Mold Co., Glendale, Calif.

14c-24. 80-Inch Die Casting Die Produces Zinc Alloy Automobile Strip. *Steel,* v. 122, April 5, 1948, p. 84.

Alloy steel die used by Gerity-Michigan Corp., Detroit.

14c-25. The Successful Melting of Copper Based Alloys. *Canadian Metals & Metallurgical Industries,* v. 11, March 1948, p. 18-19. Condensed from *Foundry Practice,* No. 88 (a British publication).

14c-26. Lengthening a Gun-Metal Spindle. G. E. Morse. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 279.

Method of casting an extra length onto a machined gun-metal spindle in the vertical position.

14c-27. Pressure-Cast Zinc Alloy Gears. *Machinery Lloyd* (Overseas Edition), v. 20, March 27, 1948, p. 79-80.

14c-28. Synthetic Resin Binders; Nonferrous Foundry Applications. H. C. Frisbie. *Metal Industry,* v. 72, April 2, 1948, p. 273.

Previously abstracted from *American Foundryman,* v. 13, Feb. 1948, p. 37-39. See item 4a-38, R.M.L., 1948.

14d—Light Metals

14d-23. 1000-Ton Die-Casting Machine. *Iron Age,* v. 161, March 25, 1948, p. 78-79.

A cold-chamber, all-hydraulic, die-casting machine for Al castings up to 15 lb. in weight. The unit is rated at 1000 tons clamping pressure, has a total injection pressure of 160,000 lb. and features an automatic feeding system in which a tilting crucible furnace pours a metered amount of aluminum for introduction into the injection chamber.

14d-24. Aluminum Alloy Castings. Floyd A. Lewis. *Foundry,* v. 76, April 1948, p. 82-85, 196-197.

5th of a series describes fluxing, grain-refining practices, and pouring procedures in the aluminum foundry.

14d-25. Aluminum Casting Weighs 2350 Lb. *Foundry,* v. 76, April 1948, p. 120.

Production of a part for a wood-veneer slicing machine.

14d-26. Die Casting Progress. Part III—Aluminum Alloy Die Casting. A. C. Street. *Metallurgia,* v. 37, Feb. 1948, p. 201-204.

Developments in the production of aluminum die castings both gravity and pressure die cast.

14d-27. "Pressure Mold" Aluminum Die Castings. Paul R. Jordan. *Machinery* (London), v. 72, March 25, 1948, p. 407-410. Based on "High Pressure Die Casting", H. L. Harvill and Paul R. Jordan. 130 pages. Harvill Mfg. Co., Vernon, Calif.

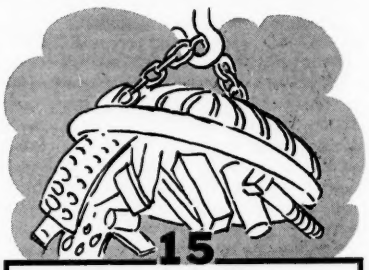
Work in production of satisfactory Al die castings for the stressed members of aircraft structures. It was necessary to "sell" the Army Air Forces on a revision of specifications, since the existing specification resulted in poor-quality parts, which in turn caused die castings to be entirely banned. Proper design to avoid porosity or shrinkage.

14d-28. Light Alloy Founding. E. Raybould. *Metal Industry,* v. 72, April 2, 1948, p. 263-266.

Operations of the Slough factory of High Duty Alloys Ltd., in Britain.

For additional annotations indexed in other sections, see:

2c-24; 4c-24; 16a-28; 23a-20; 23d-57; 24a-96; 27a-48-50; 27d-5.



15 SCRAP and BYPRODUCT UTILIZATION

15a—General

15a-5. The Disposal of Plating Room Wastes; Annual Report on A.E.S. Research Project No. 10. Barnett F. Dodge and Dinwiddie C. Reams. *Proceedings of the 34th Annual Convention, American Electroplaters' Society,* 1948, p. 249-269; discussion, p. 269.

A general review of the situation in regard to plating wastes and their disposal. After discussing the origin of the wastes and presenting some data on their volume and composition, the effects of some of the constituents of the most common wastes on aquatic life and on the operation of sewage disposal systems are briefly mentioned. Possible methods for treatment of the wastes with particular attention to chemical methods. Processes that have been tested either in pilot plants or full-scale installations. 27 ref.

15b—Ferrous

15b-10. Welding Offers New Aid. C. W. Brett. *British Steelmaker,* v. 14, March 1948, p. 140-142.

Welding repair of large steelworks machinery.

15b-11. "Facing" a Problem Which Bites Deep Into Production Costs—The Oil Industry Solves It by Applying Hard Facing. *Weld,* v. 4, March 1948, p. 12-13.

Describes and illustrates use of "acetylene Borium" for hard facing of drill-string joints.

15b-12. Wards of the Coast Guard—With the Aid of Welding Torches These Big Buoys Are Kept in Condition. *Weld,* v. 4, March 1948, p. 7-9.

Repair procedures.

15b-13. Steel Chip Salvage Handled Mechanically at Salisbury. A. D. Connelly. *Industry and Power,* v. 54, April 1948, p. 95-96.

Equipment for the chip salvage at Salisbury Axle Works, Ft. Wayne, Ind.

15b-14. Cold Repair of Broken Castings. *Machinery* (London), v. 72, Feb. 19, 1948, p. 243-244.

Use of "Metalock" system which consists essentially of inserting a series of keys transversely across the fracture.

(Turn to page 36)

Low-Alloy High-Strength Steels Surpass Copper Steels for Corrosion Resistance

Reported by John W. Watson
Metallurgist, Link-Belt Co.

Giving conclusive evidence that increased corrosion resistance is a feature of low-alloy high-strength steels, C. P. Larrabee, of Carnegie-Illinois Steel Corp., presented the technical talk at the March meeting of the Indianapolis Chapter A.S.M.

Because of their higher tensile properties these steels are now preferred in many applications where plain carbon or copper-bearing steels were formerly specified. In a great many of these uses, corrosion by atmosphere or by fresh or salt water is a vital consideration. If a steel of higher strength and consequent lighter section is used, it must likewise be of superior corrosion resistance to withstand the ravages of time.

C. P. Larrabee

The speaker correlated corrosion data collected from as early as 1912. Tabulated data showed the superior resistance of copper-bearing steels over those containing residual copper at various locations in the United States. Atmospheric corrosion was proved to be more severe during one year's exposure in industrial locations than in sea coast sites, which are often mistakenly believed to be the severest kind of exposure.

In one method of conducting these tests a number of specimens were weighed. After a period of exposure, they were removed from the holding racks, cleaned of rust, and reweighed. Over a period of years, time-corrosion curves were drawn based on the loss of weight data so collected. The experiments have shown that attack occurred in the ratio of 4 to 6 between the skyward and groundward side of specimens exposed 30° to the horizontal and facing south. This was true for all types of steel tested.

Corrosion resistance of structural steels varies so widely with conditions of exposure that exact numerical standards of comparison are impossible between the different steels. The speaker showed that uncoated copper steels have from 1.5 to 3.5 times the resistance of steels containing only residual copper, when subjected to atmospheric attack. Low-alloy high-strength steels resist from 4 to 6 times as long as plain steel, and from 2 to 3 times as long as copper steels. The low-alloy high-strength steels have an even greater margin of comparative resistance under adverse conditions.

In the high-strength alloys, a finer grained, more adhering, protective rust coating is formed, which is believed to contribute much to the resistance of these steels. All steels show less attack if the film of rust is allowed to dry frequently. Much can be done in the design of structures to prevent cavities or joints which are constantly wet. For instance, in the design of railroad gondola cars, many seams which tended to be constantly full of wet coal dust have been eliminated.

Low-alloy high-strength steels are much superior to plain steel or copper steel when painted or galvanized. A break in the coating or a porous condition will have less tendency to lift or blister the protective film.

For sea water resistance the speaker summarized tests which show that steels containing 2% or more of chromium are the best of the low-alloy types.

The only common application cited by Mr. Larrabee where the low-alloy high-strength steels have failed to justify their increased cost is for underground use. He contended that in some soils pitting is severe regardless of the steel used. In other well-drained soils, common bare pipe will last for many years.

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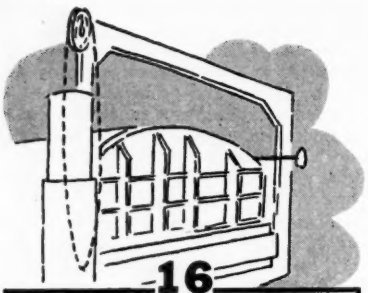


16 FURNACES and HEATING DEVICES

16a—General

16a-26. Kunstmatige Atmosfeer in Electrische Hardingsovens. (Synthetic Atmospheres in Electric Hardening Furnaces.) *Smit Mededelingen,* v. 2, Oct.-Dec. 1947, p. 93-101.

Use of various gaseous atmospheres in annealing furnaces. Improvements are suggested and development of a small generator for small and middle-sized furnaces is recommended.

16a-27. High-Speed Gas Heating for Production Forging. Frederic O. Hess. *Industrial Gas,* v. 26, March 1948, p. 5-9, 28-30.

Applications in industry and a number of commercial high-production machines for various types of applications. "Gradiation" machines developed by Selas Corp., Philadelphia, which move the stock through the furnace in continuous flow. Economy of time and higher quality of product are achieved by brief exposure to much higher temperatures than those to which the material is to be heated.

16a-28. Fuel Practices in a Foundry. Ira D. Findley. *Industrial Gas,* v. 26, March 1948, p. 10-11.

Use of natural gas in furnaces at the Homestead Valve Co., Coraopolis, Pa.

16a-29. Premixed Combustion for Efficient Process Heating. Edward J. Funk, Jr. *Industrial Gas,* v. 26, March 1948, p. 18-20, 22, 24-25.

Procedure and applications.

16a-30. Use of Radiant Tubes in the Infrared Process. R. Workman. *Gas Times,* v. 54, March 26, 1948, p. 413-414, 416.

Use in commercial finish-drying operations.

16a-31. Production Heat Treating. Part II. *Steel Processing,* v. 34, April 1948, p. 204-208.

Covers high-frequency induction-heating equipment, procedures, and applications. Use in joining of metals, forging, and melting. Effects on structure and transformation of steels as compared with conventional heating methods. 16 ref.

16a-32. It's Time to Act on Industrial Gas Heating. George A. Uhlmeyer. *American Gas Association Monthly,* v. 30, April 1948, p. 5-8, 36.

Report prepared at Battelle Memorial Institute as a result of a survey sponsored by A.G.A. and supervised by S. L. Case. It was concluded that, on the basis of the economic and engineering factors involved, modern gas-fired furnaces should be able to hold either an exclusive or at least a dominant position in numerous industrial-heating jobs.

16a-33. Blast Furnace Tapping Hole Construction. W. S. Unger. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 434-438.

16a-34. All Door Front Will Permit Use of Large Charging Boxes. L. S. Longenecker. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 447-450.

Design of doors and procedure for charging. Particular reference to open-hearth furnace is made.

16a-35. Tuyere of Novel Design Improves Furnace Operation. John H. Sprow. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 455-456.

Double-auger type allows cleaning without interrupting operations.

16a-36. Furnaces on Skids Add Forging Flexibility. *American Machinist,* v. 92, April 8, 1948, p. 92.

Three units serve many hammers. Boat mounts for furnaces, racks for controls and plug-in connections cut moving time to less than an hour.

16b—Ferrous

16b-29. Economic Considerations for Stack Lining Repairs. W. R. Trognitz. *Iron and Steel Engineer,* v. 25, March 1948, p. 65. Condensation.

Previously abstracted from *Steel,* v. 122, March 1, 1948, p. 110-112. See item 17-25, 1948.

16b-30. The Operation of a Gas-Fired Porcelain Enameling Furnace. S. E. A. Ryder. *Enamelist,* v. 25, March 1948, p. 28-35, 38-41.

Previously abstracted from *Gas Journal,* v. 253, Jan. 14, 1948. See item 17-25, 1948.

16b-31. Fifty-Ton Electric Furnace. *Western Machinery and Steel World,* v. 39, March 1948, p. 112.

At the Los Angeles plant of Bethlehem Pacific Coast Steel Corp.

16b-32. Heat Treating by "Blue Blade". K. I. Robinson. *Industrial Gas,* v. 26, March 1948, p. 15, 26-28.

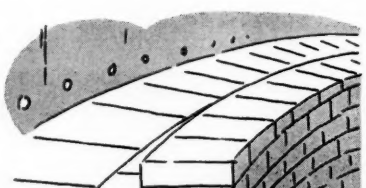
Furnace equipment and procedures in production of safety-razor blades.

16b-33. Coke Bed Ignited Electrically. *Pig Iron Rough Notes,* Winter 1948, p. 28-29.

Electric-arc device. A material cost saving of approximately $100 per mo. is claimed.

16b-34. British Annealing Furnace Heat Treats 45-Ton Plates. *Steel,* v. 122, April 12, 1948, p. 104, 106. Reprinted from *Iron and Coal Trades Review.*

For additional annotations indexed in other sections, see:
2b-61; 7b-52; 11-86; 22a-94; 27a-52.



17 REFRACTORIES and FURNACE MATERIALS

17-28. Ceramic Developments for Aircraft Power Plants. Winston H. Duckworth. *American Ceramic Society Bulletin,* v. 27, March 15, 1948, p. 93-95.

Research program of the Air Materiel Command directed toward development of refractory ceramic materials for high-temperature applications.

17-29. Life of Ladle and Spout Linings Increased With Graphite Base Refractory. *Steel,* v. 122, April 5, 1948, p. 88, 115-116.

Advantages of this refractory.

17-30. Basic Ends and All-Basic Openhearth Furnaces. R. P. Heuer and Mervin A. Fay. *Iron and Steel Engineer,* v. 25, March 1948, p. 47-58; discussion, p. 58-60.

Use of basic ends on openhearth furnaces indicates savings of the order of 10 to 25 cents per ton. Use of the all-basic furnace, although experimental at present, indicates that further savings are possible. (Presented at A.I.S.E. Detroit District Section Meeting, Nov. 11, 1947.)

17-31. Investigation of the Process of Compression Shrinkage of Single-Phase Metal-Ceramic Bodies. Part I. Part II. Relationship Between Initial and Final Densities Resulting From Constancy of the Relative Decrease in Pore Volume. (In Russian.) V. A. Ivensen. *Zhurnal Tekhnickeskoi Fiziki* (Journal of Technical Physics), v. 17, Nov. 1947, p. 1301-1320.

Volume decrease under pressure is shown to take place along with a proportional decrease in pore volume in bodies of the same composition, sintered under similar conditions. This relationship is shown to be independent of initial porosity. In Part II, the coefficient of relative pore-volume decrease determined for a specific powdered metal and specific sintering conditions is shown to be a universal indicator of shrinkage.

17-32. The Changes Occurring in Blast-Furnace Stove Refractories During Service. J. Mackenzie. *Transactions of the British Ceramic Society,* v. 47, March 1948, p. 91-105; discussion, p. 105-107.

An examination of various brands of refractories was made during two years' service in a hot-blast stove. Extent of vitrification and relationship between vitrification and thermal-shock resistance were followed by measuring variations in rigidity of the specimens during use. The ideal material seems to be a hard-fired, high-alumina brick having superior resistance to slag and vitrification, and therefore less likely to change its rigidity in use and thus set up stresses in the refractory between the vitrified and unvitrified portions.

17-33. The Properties of Blast Furnace Tapping Hole Refractories. L. L. Wells, Jr. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 451-454.

Results of research on various clays and on properties of the products. (Presented before the Blast Furnace and Coke Assoc. of the Chicago District, Nov. 21, 1947.)

17-34. Larger Carbon Blocks for Blast Furnace Linings Reduce Cost of Installation. *Steel,* v. 122, April 12, 1948, p. 101.

For additional annotations indexed in other sections, see:
2c-21; 24b-56; 27a-54.

A practical presentation of heat treatment theory
PRINCIPLES OF HEAT TREATMENT
by M. A. Grossmann
244 pages—$3.50
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Numerous Variables Enter in Estimation Of Machinability

Reported by Frank Kristufek
U. S. Steel Corp. Research Laboratory

Because of the numerous variables involved, the problems in measuring machinability of a steel are complicated and the results of such tests are often contradictory, according to A. G. Sturrock, director of research for the Wyckoff Steel Co., Chicago. However, it is a recognized fact that a definite relationship exists between the microstructure of the steel and good machining properties, he stated in his discussion of the "Relation of Microstructure of Steel to Machinability" at the February meeting of the New Jersey Chapter.

Attempts to measure machinability are usually based on the determination of cutting speed, cutting force, chip behavior, tool life, finish on cut surface, and the accuracy of dimensions of the finished product. However, the characteristics of the soft and hard constituents in the steel (ferrite, pearlite, and spheroidized carbides) and their size and distribution in the structure determine machinability, stated the speaker. In cold finished bar stock for screw machine work, lamellar pearlite is best for low and medium-carbon steels but in high-carbon steels, such as S.A.E. 1095, a spheroidized condition more readily fulfills good machining requirements.

The desired microstructure may be obtained in a steel by suitable heat treatment in accordance with the time - temperature - transformation characteristics of the material. Increasing the sulphur content, regardless of the method of addition, improves the machinability of a steel, stated Mr. Sturrock, by forming manganese sulphides which break up the continuity of the ferrite and provide chip breaker slip planes; nickel and other alloying elements may be added to change transformation characteristics in heat treatment so as to obtain the most machinable structure.

Surface finish is an important consideration in machining because it often controls the practice to be followed and the production obtained commercially. Since ferrite is the enemy of good finish, any constituent that increases the brittleness of ferrite improves machinability. Grain size of the material is another important factor to consider and, in general, a fine grain size is conducive to fine surface finish.

Throughout his talk, Mr. Sturrock stressed the importance of good metallographic technique in studying the structure of machining steels, and illustrated his points with excellent lantern slides.

"Catastrophic Oxidation" Discussed

The Action of Molybdenum in Steel Was Dubbed "Catastrophic Oxidation" by President F. B. Foley in Table Talk at National Officers' Night of the Columbus Chapter A. S. M. Reading clockwise, starting from Mrs. Sachs, caterer, are: President Foley; E. E. Thum, coffee speaker; Mars G. Fontana, vice-chairman of the chapter; C. Greenidge, past chairman; Howard C. Cross; and R. Ernie Christin, secretary

Reported by R. E. Christin
Columbus Bolt Works Co.

National Officers' Night was held in Columbus on Feb. 10, with the annual performance at Battelle Memorial Institute. Following "the best dinner this side of mother's kitchen", Charlie Lucks brought out his minstrels and entertained with new stories about the officers present. The show ended with a surprising and spontaneous outburst of song by three men whose names were selected from a hat. The performers were Stu Oliver (a Cleveland guest), Bruce Gonser, and R. E. Christin.

Down in the auditorium, Ernest Thum, editor of *Metal Progress*, subbed for Bill Eisenman, and did a fine job with stories about the far west, the activities of A.S.M., and the usual promise that the new Handbook would soon be forthcoming, believe it or not. We did learn that even a horse gets two olives in a double martini, but you must go to Charlie Russell's place in Sheridan, Wyo., to prove it.

President Foley then gave a lengthy discussion of the behavior of metals under stress at elevated temperatures and aroused lively questioning by Battelle experts.

Metallurgist and Designer Work Hand in Hand on Stress-Strength Problems

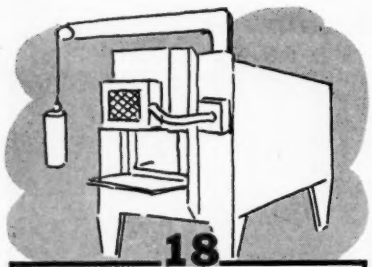
Reported by John F. Collins
University of Notre Dame

The need for the designer and the metallurgist to work hand in hand was emphasized by Charles Lipson of the Detroit Testing Laboratory, when he addressed the March meeting of the Notre Dame Chapter. "Factors of Stress and Strength" was the title of the address. This was a joint meeting of the Notre Dame Chapter A.S.M. with the St. Joseph Valley Section of the American Society of Mechanical Engineers.

The ideal design can be defined as just good enough to do the job, for there is waste if the part is too strong and failure if the part is too weak. To obtain this delicate balance between success and failure, the metallurgist and mechanical engineer must be ever aware of each other's problems. The stresses of a member are of prime concern to the mechanical engineer in the design of the unit. The strength of the material, which is an evaluation of the physical properties, is the problem of the metallurgist.

Dr. Lipson divided his talk into three major parts, discussing first stress, then strength, and finally the balance between stress and strength. Of the many methods of stress analysis on complicated sections, the speaker described the photo-elastic and strain gage methods, using slides for illustrations. Strength is a very elusive term, almost defying definition; consequently, the designer and the metallurgist must be accurate when discussing physical properties.

The principle of under-over stress as related to the endurance limit was discussed by the speaker. When a member is stressed to slightly below the endurance limit, it is stronger than it was prior to the stress. A member stressed beyond the endurance limit is permanently injured.



18 HEAT TREATMENT

18b—Ferrous

18b-45. Rapid Annealing of Malleable Iron Castings. Gabriel Joly. *Foundry Trade Journal,* v. 84, Feb. 26, 1948, p. 200-202. Translated from *Fonderie,* Oct. 1947, p. 857-860.

Previously abstracted. See item 18b-23, 1948.

18b-46. Whiteheart Malleable; A Review of Recent Developments in Industrial Gaseous Annealing. P. F. Hancock. *Iron and Steel,* v. 21, March 1948, p. 105-108.

(To be concluded.)

18b-47. A Comparison of Patenting Methods; Coal—Gas—Electric. *Wire Industry,* v. 15, March 1948, p. 187.

Heat treatment procedure for high carbon rods and wire up to 0.85%, which may be termed a continuous individual-strand treatment, in which the steel is heated to above critical temperature and cooled below that range in air, molten lead, or molten salts.

18b-48. How to Select Quenching and Tempering Oils for Treating Steel. E. L. H. Bastian. *Steel,* v. 122, March 22, 1948, p. 64-66, 86, 89; March 29, 1948, p. 79-82, 84.

The nature and function of various heat treating media, and the mechanics of quenching. Total-immersion quench methods for correlating comparative quench efficiencies with commercial experience, and martempering, austempering, tempering, annealing, and normalizing.

18b-49. Induction Hardening Reduces Blade Cost. *Electronics,* v. 21, April 1948, p. 134.

Use of a radio-frequency generator has enabled Hancock Manufacturing Co. to reduce the cost of hardening grass-shear blades from 2.5 to 1 cent per blade. In addition, quality is improved.

18b-50. Progress in the Heat Treatment of Steel. E. S. Davenport. *Scientific American,* v. 178, April 1948, p. 148-153.

Techniques used for isothermal transformation studies which have supplied the metallurgist with a new range of useful properties.

18b-51. Heat Treating 54-Foot Alloy Bars. F. H. Bremmer. *Steel,* v. 122, April 5, 1948, p. 77-78, 101-102.

New equipment for heat treating alloy steel bars before fabrication into drill collars. This oil quenching and tempering eqeuipment is designed to produce bars of uniform hardness which require a minimum of cold straightening after heat treating.

18b-52. Martempering of K-46 Tool and Die Steel. G. L. Kehl. *U. S. Atomic Energy Commission.* MDDC-526; LADC-205, Dec. 12, 1946, 9 pages.

Process applicable to sections not more than 1-in. thick. K-46 contains 0.85 to 0.95% C, 0.25 to 0.45% Si, 1.00 to 1.25% Mn, 0.40 to 0.60% Cr, 0.40 to 0.60% W, and 0.10% V.

18b-53. Stress-Relief Treatment of Iron Castings; Report of Sub-Committee T. S. 17 of the Technical Council of the Institute of British Foundrymen. *Foundry Trade Journal,* v. 84, March 25, 1948, p. 303-306, 308.

The available literature, private information, and questionnaire data are correlated and recommendations for full and modified stress relief. 11 ref.

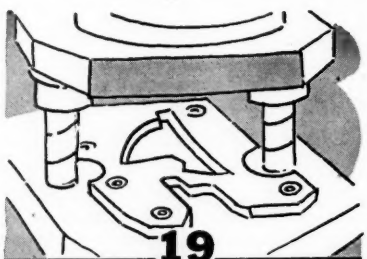
18b-54. Coalescing Anneals. J. J. Curran. *Metal Progress,* v. 53, April 1948, p. 536-537.

Discusses letter by M. Portevin on above subject (Nov. 1947 issue) and also the development of theory and practice of spheroidizing steel at temperatures above AC_1.

18b-55. The Practical Heat Treatment of High Speed Steel Cutting Tools. W. E. Bancroft and W. W. Wight. *Metal Progress,* v. 53, April 1948, p. 545-555.

Recommended austenitizing conditions; rates of heating and cooling; temperatures of quenching before tempering; tempering conditions; uses of isothermal transformation; and surface conditions.

For additional annotations indexed in other sections, see:
16a-31; 16b-32-34; 23d-57; 27d-5.



19 WORKING

19a—General

19a-57. Hydraulics and the Tangent Bender. Lee B. Green. *Applied Hydraulics,* v. 1, Feb. 1948, p. 28-29, 32.

Application of hydraulic power to a production machine for edge and stretch bending and radial forming of metal sheets, structurals, and tubes.

19a-58. Lubrication in Drawing. T. Waterfall. *Machinery Lloyd* (Overseas Edition), v. 20, Feb. 28, 1948, p. 103-105.

19a-59. The Rolling of Metals: Theory and Experiment—Part XVI. A Survey of Present Knowledge and the Direction of Future Research. (Continued.) L. R. Underwood. *Sheet Metal Industries,* v. 25, March 1948, p. 497-502.

Qualitative and quantitative use of the "friction hill" theory of rolling and the present state of knowledge and discussion of useful avenues for further research, particularly from the viewpoint of the rolling-mill designer and operator. (To be continued.)

19a-60. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 25, March 1948, p. 511-516.

This installment covers squaring, circle cutting, and other operations; trimming on the lathe; a cutter for heavy trimming; and a trimming mandrel. (To be continued.)

19a-61. The Shaping of Metals. Francis W. Boulger. *Metals Review,* v. 21, March 1948, p. 3, 5, 7.

Progress in hot working, cold forming, and machining based on an analysis of the past year's Technical Literature. References to "A.S.M. Review of Current Metal Literature".

19a-62. Solving Punch Press Problems Economically. H. J. Chamberland. *Western Machinery and Steel World,* v. 39, March 1948, p. 96-99.

Cost-saving advantages of lightweight, small-sized presses for small parts. Prior to World War II, it was common practice to use heavy machinery for small jobs, such as use of a 30-ton press to blank disks the size of silver dollars. Selection of punch-press sizes suitable, but not unnecessarily large, for the job to be done.

19a-63. Wire Netting Industry; Fast Small Mesh Machines. *Wire Industry,* v. 15, March 1948, p. 181. Condensed from B.I.O.S. Report No. 1288.

Results of inspection of four German plants for manufacture of wire netting.

19a-64. Profile of Wire-Drawing Dies; New Checking Method. J. G. Wistreich. *Wire Industry,* v. 15, March 1948, p. 171.

Development of improved method using a dental compound known as "Zelex" to check die shapes to production standards.

19a-65. Presses and Tools. *Metals Review,* v. 21, March 1948, p. 9, 11, 13, 15, 17, 19, 21, 23.

New equipment for shaping and cutting of metals, introduced during the past year.

19a-66. Progressive Die Design. Part III. C. W. Hinman. *Modern Machine Shop,* v. 20, April 1948, p. 142-144, 146, 148, 150.

Construction of a "cut-and-carry" progressive die.

19a-67. The Theory of "Unit Compressive Stress" of Metals During Drawing. (In Russian.) S. I. Gubkin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R. Section of Technical Sciences), Dec. 1947, p. 1663-1681.

According to the theory proposed, the energy involved in wire-drawing operations may be divided into that used for "basic" deformation, "additional" deformation and that required to overcome frictional forces. Formulas for calculation of these values.

19a-68. Grafisk Valskalibrering. (Graphic Roll Pass Designing.) Gunnar Wallquist. *Jernkontorets Annaler,* v. 132, no. 2 1948, p. 27-41.

Method of calculation based upon certain linear dimensions instead of area relations. The dimensions are calculated by use of diagrams, based on experience with different rolling conditions. Application to some very common types of rolling, i. e. rolling of billets in diamond passes, and guide rolling of round bars with alternating square and round passes in the strand rolls. The designing of series for the rolling of square, hexagon, octagon and other simple sections. For other than round sections, graphic designing according to the comparative and the logarithmic method.

19a-69. Rolling Mills; Methods of Roll Load and Power Calculation. L. R. Underwood. *Metal Industry,* v. 72, Feb 27, 1948, p. 166-169; March 5, 1948, p. 187-190; March 19, 1948, p. 231-234.

Principal methods and their relative merits and defects. 26 ref. (Pre-

(Turn to page 40)

Chicago U Studies Lithium Transformation, Stress-Strain Curves, Friction

Reported by George Sommer
Graduate Student, Purdue University

Fundamental research is being conducted at the newly formed Institute for the Study of Metals at the University of Chicago with emphasis on understanding the science of metals and with little regard given to any immediate application for the work, said Charles S. Barrett, addressing the March meeting of the Purdue Chapter A.S.M.

Among the interesting research projects in progress at Chicago, Dr. Barrett talked on the work with lithium which transforms only 7° below the lowest temperature at which the metal had previously been investigated. Lithium is an ideal material for these studies as it can be annealed by merely pressing between the thumb and forefinger and hot worked by bending back and forth in the hand. X-ray studies of the lithium transformation show many similarities to transformations in steel and suggest some new principles that may hold for all similar transformations.

Stress-strain curves showing steplike behavior, which has been frequently noticed in the past but considered poor data, are also being investigated at the Institute. This phenomenon in the study of 2-S aluminum was explained with a series of slides. By fitting the test specimens with strain gages at known intervals, it is possible to measure the velocity of propagation of the strain along the bar. The dependence on testing temperature and the possible explanations are being explored.

Out of the extensive internal friction research at the Institute comes the possibility of very sensitive quantitative analysis of dissolved gases in metals.

Dr. Barrett presented a summary of some of Dr. Cyril Smith's work on considering metallic grain boundaries as the result of surface tension forces. Within any grain, included material appears perfectly spherical and at the boundary of two or three grains the material collects in geometrical shapes from which the surface forces can be determined. Complete penetration between grains brings embrittlement, and can be controlled by controlling the surface tension forces.

Dr. Barrett's address was preceded by a coffee talk by E. R. Vance, chief chemist of the Steel and Tube Division, Timken Roller Bearing Co., on the direct-reading spectrometer used in conjunction with the firm's melting department, which includes a 100-ton electric arc furnace. Although carbon, sulphur and phosphorus are still detrimental in the wet lab, alloying elements in the heat can be rapidly determined on the spectrometer—entirely eliminating the photographic work normally performed. The images from the grating are detected by electronic circuits, rather than photographic plates, and dials thereby actuated on which the composition is directly read in 35 sec. The results are transmitted to the furnace operator by Telautograph, to be used for calculating alloy additions to the molten metal bath.

The film also showed very clearly the operation of the world's largest arc furnace. A heat was followed step by step from the charging, through the lowering of the six large electrodes into the scrap and on to the tapping of the heat. Sampling methods were also shown as well as preparation of the samples for use in the spectrometer.

Dr. Enos, Professor of Metallurgy at Purdue, was technical chairman for the meeting and conducted a question period following Dr. Barrett's address.

C. S. Barrett (Extreme Right) Recounted Some of the Fundamental Studies Being Conducted at the Institute for the Study of Metals When He Addressed the March Meeting of the Purdue Chapter A. S. M. In the photograph (from left) are: Harold Graves, secretary-treasurer of the Purdue Chapter; Thomas McCormick, vice-chairman; Harold Bates, chairman; E. R. Vance, who described the use of the direct-reading spectrometer at Timken Steel & Tube Division; George M. Enos, technical chairman; and Dr. Barrett, the principal speaker

Named Sales and Adv. Mgr.

Joseph H. Humble of the Kester Solder Co., Chicago, has been appointed general sales and advertising manager. Mr. Humble has been associated with Kester Solder Co. for 25 years.

Focke Is Main Speaker At Wichita Officers Night

Reported by James W. Haupt
Chief Design Engineer
Cardwell Mfg. Co., Inc.

The science of metallurgy and its place in modern industry were defined in a speech on "The Metallurgist, the A.S.M. and the Metals Industry" presented before National Officers' Night of the Wichita Chapter A.S.M. on March 16. Arthur E. Focke, chief metallurgist of Diamond Chain Co. and national trustee of A.S.M., was the featured speaker. Brief details of his talk are reported on page 45.

The main event was preceded by a buffet supper and a "get-acquainted" period. Coffee talk was by J. Alden Trovillo, manager of the industrial department of the Wichita Chamber of Commerce.

Alcoa Plant Nears Completion

More than 6¼ million pounds of aluminum is being used in the construction of the nearly completed sheet and plate rolling mill of the Aluminum Co. of America in Davenport, Iowa. The giant plant is basically an all-aluminum project, with the exception of 25,000 tons of structural steel framework which is painted with more than three carloads of aluminum paint. The plant is being equipped to turn out the widest aluminum sheet in the world.

sented at meeting of Institution of Mechanical Engineers.)

19a-70. A Critical Survey of Wire-Drawing Theory. G. D. S. MacLellan. *Journal of the Iron and Steel Institute,* v. 158, March 1948, p. 347-356.

Theories relating to determination of stresses during drawing. Errors and inconsistencies in many of these theories, and the more significant contributions. Some ways of testing those theories which give results in reasonable agreement with experience are considered, and attention is drawn to some of the more important conclusions which can be drawn from them. 31 ref.

19a-71. Back-Pull Wire Drawing; A Critical Review of Literature. (To be continued.) J. G. Wistreich. *Wire Industry,* v. 15, March 1948, p. 177-180.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Nov. 1947, p. 417-428. Item 19a-1, R.M.L., 1948.

19a-72. Drawing Thin-Walled Shells of Intricate Shape. D. A. Baker. *Machinery* (London), v. 72, March 18, 1948, p. 363-366.

The problems involved illustrated by an example of the drawing of a radio-tube part of Armco iron, to limits of ± 0.003 in., which involved three types of drawing problems. Methods.

19a-73. Shot-Peening Equipment. R. Ankers. *Machinery* (London), v. 72, March 25, 1948, p. 400-401. Condensed from "Developments in Shot-Blasting" read recently before Manchester Association of Engineers.

Equipment and methods.

19a-74. The Institute of Metals. *Engineering,* v. 165, March 26, 1948, p. 304-305.

Begins extended condensation of papers presented at annual general meeting, March 16-18, 1948. Calculation of Loads Involved in Metal Strip Rolling, by M. Cook and E. C. Larke; Hot Shortness of Some High-Purity Alloys in the Systems Aluminum-Copper-Silicon and Aluminum-Magnesium-Silicon, by P. H. Jennings, A. R. E. Singer, and W. I. Pumphrey; and A Consideration of the Constitution of Aluminum-Iron-Silicon Alloys and Its Relation to Cracking Above the Solidus, by P. H. Jennings and W. I. Pumphrey. (To be continued.)

19a-75. Development of Low Weight Forgings. J. H. Friedman. *Steel Processing,* v. 34, April 1948, p. 183-190, 192.

Low-weight forgings as referred to in this paper are forgings that have been designed and produced so as to reduce scrap loss in the form of crop ends, flash trimmings, and machining chips to a minimum. Parts to which the design principles were applied.

19a-76. Versatile Applications of the Press Brake. W. Earl Peters. *Machinery,* v. 54, April 1948, p. 143-150.

Use of several types of power-operated press brakes. Materials that can be formed, tolerances maintained, and operations possible.

19a-77. The Design and Function of a Sliding Cone Punch. Louis J. Lovisek. *Tool Engineer,* v. 20, April 1948, p. 21-24.

Many uses in cold forging. The two types in common use are the "hit" and the "free" types.

19a-78. Progressive Die Slashes Tooling. *American Machinist,* v. 92, April 8, 1948, p. 86-87.

Nine-station progressive die to produce terminals for fluorescent-lamp sockets. In original production, several dies and machining operations were required. Present set-up combines 17 operations on two parts at a time at a rate of 1400 parts per min. Scrap totals only 0.0818 sq. in. per part.

19a-79. Kirksite Dies for Auto Stampings. Walter G. Patton. *Iron Age,* v. 161, April 15, 1948, p. 78-81.

Use soft nonferrous alloy for short-run or pilot production of sheet-metal parts for automobiles, commercial trucks, buses, and trailers, and methods for their production. They are made by a casting process using plaster models. Vacuum is used in casting the smaller dies.

19a-80. Selecting Drawing Lubricants; Determining Factors to Consider. W. J. Haring. *Steel,* v. 122, April 19, 1948, p. 86, 88, 91.

Some of the many variables that should be considered in choosing drawing compounds. (Presented at New England district meeting, Pressed Metal Institute, Jan. 13, 1948.)

19b—Ferrous

19b-46. The Y-Mill. A New Type of Cold Strip Mill. A. B. Montgomery and W. M. McConnell. *Iron and Steel Engineer,* v. 25, March 1948, p. 99-104; discussion, p. 104.

Unique, reversing cold mill which offers possibilities for economy of operation and quality of product rolled. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 22, 1947.)

19b-47. Die for Square-Cornered Airtight Containers. *Machinery* (London), v. 72, March 4, 1948, p. 308-309.

19b-48. Determining Origin of Surface Defects in Rolled Steel Products. V. E. Elliott and C. L. Meyette. *Steel,* v. 122, March 29, 1948, p. 92, 95-96.

Previously abstracted from *Railway Age,* v. 124, March 6, 1948, p. 54-56. See item 19b-43, 1948.

19b-49. Extrusion Forging Ready for Mass Production. *Automotive Industries,* v. 98, April 1, 1948, p. 40, 60.

Initial application at Ford's Canton, Ohio, foundry will be to steel spindles, with other parts to follow. Pilot operation discloses engineering and manufacturing economies.

19b-50. Shot-Peening Castings. C. R. Austin. *Steel,* v. 122, April 5, 1948, p. 79-82, 84.

Results of a study of the effect of shot-peening on "GA Meehanite" (a special cast iron). It was found that endurance limit under load and reversed-bending stresses during rotation was not improved. However a large increase in fatigue life at stresses greater than the endurance limit was obtained.

19b-51. Shot-Peening to Increase Wear Resistance. *World Oil,* v. 127, April 1948, p. 192.

Process and its applications. Effects on different steels.

19b-52. Weirton Steel Rolls Tin-Plate on High Speed Mill. M. J. Wohlgemuth. *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 431-433.

19b-53. Largest Mechanical Press Stamps 32-Ft. Rails. Jack K. Ferguson. *Steel Processing,* v. 34, April 1948, p. 191-192.

Production of automotive-frame rails.

19b-54. Tube Production Increased by New Mill. *Production Engineering & Management,* v. 21, April 1948, p. 57.

New mill for continuous electric welding of steel tubing.

19b-55. Spin 6-in. Thick Steel Plate. *American Machinist,* v. 92, April 8, 1948, p. 83-84.

Forming of elliptically dished tank heads by spinning steel plate in thicknesses up to 6 in. and diameters as large as 18 ft.

19b-56. Fundamentals of Cold Heading. H. E. Linsley. *American Machinist,* v. 92, April 8, 1948, p. 99-110.

Comprehensive report. Cold-heading equipment; punch and die design; and selection of alloys for the punches and dies, as well as for fabrication by the process.

19b-57. Roll Life Increased 35% by Controlled Airless Blasting. *Steel,* v. 122, April 12, 1948, p. 116.

Roll-roughing machine. Abrasive blasting is used to dress as many as five rolls per hr.

19c—Nonferrous

19c-12. Combination Die to Bend and Cut Wire. Federico Strasser. *Tool Engineer,* v. 20, April 1948, p. 34.

Designed for production of a specific piece made from copper wire.

19d—Light Metals

19d-18. Works Practice in the Rolling and Extrusion of Aluminum at the Rogerstone Works of the Northern Aluminium Co., Ltd. (Concluded.) Alastair McLeod. *Sheet Metal Industries,* v. 25, March 1948, p. 491-496, 508.

Final installment describes the extrusion presses and heat treatment furnaces; as well as distribution systems for electricity, gas, water, and compressed air, the ventilation system, the cranes.

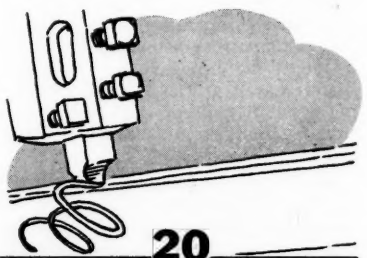
19d-19. The Manufacture of Aluminum Wire; Processes and Plant Described. *Wire Industry,* v. 15, March 1948, p. 185-186.

19d-20. Forming Magnesium and Aluminum. *Aircraft Production,* v. 10, April 1948, p. 138.

Comparative tests on a rubber press.

For additional annotations indexed in other sections, see:

3c-24; 16a-36; 20a-160; 21a-66; 22b-115; 24a-88; 24b-51; 24d-12.



20

MACHINING and MACHINABILITY

20a—General

20a-132. Hydraulic Operation for a Five Station Production Machine. *Applied Hydraulics,* v. 1, Feb. 1948, p. 24-25.

A high-production, special-processing machine into which are incorporated self-contained hydraulic systems in each of five stations, a motor-driven hydraulic unit for indexing, and a circuit for locking the machine table. The machine drills, reams, and counterbores Kaiser-Frazer engine connecting rods and caps.

(Turn to page 42)

Metallurgical Books

By Sibyl E. Warren

Lingren Library, Mass. Inst. of Technology

A Bibliography, Classified by Subject Matter, of Metallurgical and Near-Metallurgical Books Published in the Years 1936-1946

THE FIRST TWO installments in this bibliography were published in the March and April issues of *Metals Review*. The present portion comprises Sections B-2 on Metallography and B-3 on Heat Treating, as shown in the classification scheme alongside. Subsequent issues will carry succeeding sections of the bibliography.

* * *

B-2. Metallography

Desch, C. H. **Metallography.** Ed. 4. Longmans, Green and Co., London, 1937, 402 p.

Desch, C. H. **Metallography.** Ed. 5. Longmans, Green and Co., London, 1942, 408 p.

Desch, C. H. **Metallography.** Ed. 6. Longmans, Green and Co., London, 1945, 408 p.

Dowdell, R. L. and others. **General Metallography.** John Wiley & Sons Inc., New York, 1943, 292 p.

Eckel, J. F. and Raudebaugh, R. J. **Laboratory Manual in Metallography.** McGraw-Hill Book Co., Inc., New York, 1946, 344 p.

Greenwood, J. N., comp. **Glossary of Metallographic Terms.** Tait Publishing Co., Ltd., Melbourne, 1940, 80 p.

Hanemann, Heinrich and Schrader, Angelica. **Atlas Metallographicus. I. Iron and Steel. II. Nonferrous Metals.** Ed. 2. Borntrager, Berlin, 1939.

Kehl, G. L. **The Principles of Metallographic Laboratory Practice.** McGraw-Hill Book Co., Inc., New York, 1939, 359 p.

Kehl, G. L. **The Principles of Metallographic Laboratory Practice.** Ed. 2. McGraw-Hill Book Co., Inc., New York, 1943, 453 p.

McMullan, O. W. **Metallography.** Parts 1 an 2. International Textbook Co., Scranton, Pa., 1940.

Mies, Otto. **Metallographie. Grundlagen und Anwendungen.** Ed. 2, rev. Springer Verlag, Berlin, 1942, 68 p.

Mitsche, Roland and Niessner, M. **Angewandte Metallographie.** J. A. Barth, Leipzig, 1939, 229 p.

Rolfe, R. T. **A Dictionary of Metallography.** Chapman and Hall, Ltd., London, 1945, 243 p.

Vekshinsky, S. A. **New Method for the Metallographic Study of Alloys.** (In Russian) Ogiz, Gostekhizdat, Moscow, 1944, 252 p.

Vilella, J. R. **Metallographic Technique for Steel.** American Society for Metals, Cleveland, 1938, 84 p.

Wassermann, Guenter. **Texturen metallischer Werkstoffe.** J. Springer, Berlin, 1939, 194 p.

Weiland, W. F. **Metallography.** Burgess Publishing Co., Minneapolis, Minn., 1938, 84 p.

Classification Scheme

I. Metallurgy (in General)

(A) Process Metallurgy

1. Ore Dressing
2. Pyrometallurgy, Hydrometallurgy, Electrometallurgy
3. Furnaces, Refractories, Fuels, Slags, Temperature, Pyrometry

(B) Physical Metallurgy

1. Structural and Properties of Metals and Alloys
   (a) Phase Relations
2. Metallography
   (a) Microscope, Polishing, Etching
   (b) X-Ray Analysis, Radiography
3. Heat Treating
4. Testing and Mechanical Properties
5. Corrosion and Oxidation

(C) Mechanical Metallurgy

1. Powder Metallurgy
2. Casting
   (a) Patterns, Molds, Foundry Sands
3. Welding and Cutting
   (a) Electric
   (b) Gas
   (c) Soldering
4. Other Processes: Forging, Rolling, Extrusion, Drawing, Stamping, Spinning, Machining
5. Surface Treatment
   (a) Plating, Galvanizing
   (b) Enameling, Coloring, Spraying
   (c) Others

II. Metals (in General)

(a) Analysis

(A) Ferrous

(a) Biography, Economics, History
1. Iron
   (a) Cast
   (b) Iron and its Alloys
2. Steel
   (a) Special Steels

(B) Nonferrous

1. Aluminum, Magnesium
2. Brass, Bronze, and Bearing Metals
3. Copper
4. Gold, Silver, Platinum, and Other Precious Metals
5. Other Nonferrous Metals and Alloys

Williams, R. S. and Homerberg, V. O. **Principles of Metallography.** Ed. 4. McGraw-Hill Book Co., Inc., New York, 1939, 339 p.

(a) Microscope, Polishing, Etching

Allen, R. M. **The Microscope.** D. Van Nostrand Co., Inc., New York, 1940, 286 p.

Allen, R. M. **Photomicrography.** D. Van Nostrand Co., Inc., New York, 1941, 365 p.

Berglund, Torkel. **Handbuch der metallographischen Schleifpolier und Atzverfahren.** Rev. ed. by A. Meyer. J. Springer, Berlin, 1940, 300 p.

Burton, E. F. and Kohl, W. H. **The Electron Microscope.** Reinhold Publishing Co., New York, 1942, 233 p.

Burton, E. F. and Kohl, W. H. **The Electron Microscope.** Ed. 2, rev. & enl. Reinhold Publishing Co., New York, 1946, 325 p.

Eastman Kodak Co., **Photomicrography, an Introduction to Photography With the Microscope.** Ed. 14. Company, Rochester, N. Y., 1944, 174 p.

Gabor, Dionys. **The Electron Microscope, Its Development, Present Performance, and Future Possibilities.** Hulton Press, Inc., London, 1945, 104 p.

Greaves, R. H. and Wrighton, H. **Practical Microscopical Metallography.** Ed. 3, rev. & enl. Van Nostrand & Co., New York, 1940, 272 p.

Malette, Joseph. **La métallographie en coleurs appliquée a l'examen microscopique des métaux ferreux.** Dunod, Paris, 1938, 56 p.

Schrader, Angelica. **Aetzheft.** Ed. 2. Gebruder Borntraeger, Berlin, 1939, 24 p.

Shillaber, C. P. **Photomicrography in Theory and Practice.** John Wiley & Sons, Inc., New York, 1944, 773 p.

Zworykin, V. K., Morton, G. A., Ramberg, E. G., Hillier, J. and Vance, A. W. **Electron Optics and the Electron Microscope.** John Wiley & Sons, Inc., New York, 1945, 766 p.

(b) X-Ray Analysis, Radiography

American Society for Testing Materials. **Symposium on Radiography.** Society, Philadelphia, 1943, 256 p.

Canadian Radium & Uranium Corp. Technical Staff. **A Manual on Industrial Radiography With Radium.** Corporation, New York, 1942, 79 p.

Clark, G. L. **Applied X-Rays.** Ed. 3. McGraw-Hill Book Co., Inc., New York, 1940, 674 p.

Crowther, J. A., ed. **Handbook of Industrial Radiology.** Edward Arnold and Co., London, 1944, 203 p.

Delpech, S. A. **Los rayos X en el estudio de los metalles.** Talleres graficos "Tomas Palumbo", Buenos Aires, 1941, 160 p.

(Turn to page 43)

20a-133. You Can Use Cemented Carbide Tools Successfully. Part III. *Western Machinery and Steel World,* v. 39, March 1948, p. 111.

Recommended tool-positioning and machine-checking procedures.

20a-134. Correct Use of Standard Equipment Pays Dividends in Chip Disposal. *Flow,* v. 3, March 1948, p. 26-27, 49.

Jack & Heintz method of disposal from machine to scrap-removal truck.

20a-135. Thread Cutting in the Lathe. Carl Thomas. *Power Generation,* v. 52, March 1948, p. 72-76.

Instructions for cutting threads of various kinds.

20a-136. Two Successful Jobs by Skiving. J. Harrow. *Screw Machine Engineering,* v. 9, March 1948, p. 33-37.

Details of setups for production of two different designs of the metal part at the tip of an automatic pencil.

20a-137. Milling a Hexagon With a Cross Slide Attachment. E. P. Ranney. *Screw Machine Engineering,* v. 9, March 1948, p. 40-43, 46.

A special attachment which, when applied to a standard automatic screw machine, makes it possible to complete the part on one machine tool.

20a-138. Profile Turning a Cam Contour on the Brown & Sharpe Automatic. A. F. Barker. *Screw Machine Engineering,* v. 9, March 1948, p. 47-49.

20a-139. Disk-Type Screw Machine Cam Cutter. A. G. Jacobson. *Screw Machine Engineering,* v. 9, March 1948, p. 50-52.

Attachment and its uses.

20a-140. Automatic Work-Indexing Device for Milling Machine. *Machinery* (London), v. 72, March 4, 1948, p. 307-308.

20a-141. Power Feeding Mechanism for Band-Saw. *Machinery* (London), v. 72, March 4, 1948, p. 309-311.

Patented mechanism for use on metal-cutting band-saws.

20a-142. German Machine Tool Developments. *Iron Age,* v. 161, March 25, 1948, p. 77.

Series of reports issued by the Office of Technical Services, U. S. Dept. of Commerce.

20a-143. Shop Shots at Lord Mfg. Co. Walter Rudolph. *American Machinist,* v. 92, March 25, 1948, p. 96-97.

Six operations utilizing unusual machining techniques.

20a-144. Practical Ideas. *American Machinist,* v. 92, March 25, 1948, p. 117-122.

Use of gage-block assemblies to build-up precise snap and limit-snap gages (S. Framurz); drilling of large panels by use of portable drill press mounted on top of the panels using a metal strip attached by clamps (Harry Stern); use of sample part for gage turning of new part to identical taper (Don J. W. Tibbits); improved procedure for finishing shoulders (Lewis F. Cheek); cutting splines by use of set of broaches with single progressive edges (Harry Stern); use of dial gage to indicate deviation from perfect square or from vertical position (D. P. Campbell); conversion of lathe steadyrest to ball-bearing rest to eliminate stock marking (William E. Blackham); and other miscellaneous shop hints.

20a-145. By Honing Cylindrical Parts Fast Stock Removal, Fine Finish and Close Accuracy Are Obtained. C. Allen Fulmer. *Machine and Tool Blue Book,* v. 44, April 1948, p. 133-138, 140, 142.

Advantages and applications of honing process. Various parts which have been successfully honed. Honing abrasives and procedural suggestions.

20a-146. First Transfer Machine for Drilling Crankshaft Oil Holes. *Automotive Industries,* v. 98, April 1, 1948, p. 36, 76.

Machine introduced by Ford Motor Co.

20a-147. Positive Locating Drilling Jig. Robert Mawson. *Iron Age,* v. 161, April 1, 1948, p. 83-85.

Positive location of the part to be drilled, quick positioning, and ease in handling, are features of the jig. Although designed for a specific part, the idea may be applied to other drilling operations.

20a-148. Pin Hole Drilling Simplified With All-Purpose Jig. Robert Mawson. *Steel,* v. 122, April 5, 1948, p. 91, 94.

Universal drill jig for drilling small holes in studs, bolts, and pins.

20a-149. Cams—Their Production and Application. John E. Hyler. *Machine and Tool Blue Book,* v. 44, April 1948, p. 179-180, 182, 184, 186, 188, 190.

Fourth of series discusses types of cam followers and machines for cam milling. (To be concluded.)

20a-150. A Back Facing Tool for Use on the Drilling Machine. G. R. Milner. *Machinery* (London), v. 72, Feb. 19, 1948, p. 246.

Tool permits rapid back-facing of internal bosses to length. It is of simple construction, and can be used on any drilling machine without disturbing the workpiece or reversing the machine spindle.

20a-151. Modern Cutting Tools and Machine-Tool Design. C. Eatough. *Engineering,* 165, Feb. 20, 1948, p. 189-192. A condensation.

Previously abstracted from *Engineer,* v. 185, Jan. 9, 1948, p. 53; discussion, p. 52; Jan. 16, 1948, p. 75-77. See item 20a-130, R.M.L., 1948.

20a-152. Gage and Tool Exhibition, 1948. Paul Grodzinski. *Industrial Diamond Review,* v. 8, March 1948, p. 69-78.

Equipment at British show.

20a-153. Present Status of Crush-Truing. D. H. Currie. *Industrial Diamond Review,* v. 8, March 1948, p. 82-84.

History; the wheel required; centerless thread grinding; lubricants; and other applications. (Presented at A.S.T.E. meeting, Detroit, March 19, 1947.)

20a-154. New Plant and Tools. *Automobile Engineer,* v. 38, March 1948, p. 106-108.

Recent development in production machine-shop equipment.

20a-155. Lifting Arrangements for Jig Plates. R. Harries. *Machinery* (London), v. 72, March 11, 1948, p. 343-344.

20a-156. Cost Saving on Slot Milling Operations. *Machinery* (London), v. 72, March 11, 1948, p. 345-347.

As used in production of radiator cores.

20a-157. Two Large British Machine Tools. *Engineer,* v. 185, March 12, 1948, p. 255-257.

Gear-hobbing machine capable of cutting gears up to 21 ft. in diameter and 8 ft. in width; and boring-and-turning mill for work up to 24 ft., 3 in. diameter by 15 ft. high.

20a-158. Boring Bars for Horizontal Machines. G. R. Milner. *Machinery* (London), v. 72, March 18, 1948, p. 366.

20a-159. Contour Milling of Grooves. *Machinery* (London), v. 72, March 18, 1948, p. 373.

Method used for milling slot in cylindrical parts so that the bottom surfaces of the slots are parallel over part of their length and tapering for the remainder.

20a-160. Coolants for Metal Working. E. L. H. Bastian. *Lubrication Engineering,* v. 4, April 1948, p. 75-80.

Various types and their maintenance and selection for specific applications. Machining and metal working applications, in the latter of which the "coolants" are more properly referred to as "lubricants".

20a-161. Fats and Oils for Grinding and Polishing. E. W. Steinitz. *Lubrication Engineering,* v. 4, April 1948, p. 81-85.

Properties of the various substances used as suspending liquids for abrasives.

20a-162. Machining and Assembly Operations on the Automatic. S. L. Daugherty, *Screw Machine Engineering,* v. 9, April 1948, p. 31-35.

Production and assembly operation on a comparatively simple screw-machine part with a 0.87-in. steel ball assembled within a 0.188 in. hole and the 45° angle spun over to secure the ball within the part. The ball must be assembled in a manner so that it rotates freely without excessive shake or end movement.

20a-163. Squaring a Round Hole. E. P. Ranney. *Screw Machine Engineering,* v. 9, April 1948, p. 37-40.

Sequence of operations and feeds and speeds applied to produce part requiring above operation complete in 5 sec. on a $\frac{5}{16}$" RA6 Acme Gridley automatic.

20a-164. Increase Production 200% With Skiving Tools. A. F. Parker. *Screw Machine Engineering,* v. 9, April 1948, p. 41-44.

Second of a series of articles dealing with screw-machine techniques in manufacture of cameras. Production of complex part with only 0.0155-in. wall thickness between a 0.125-in. hole and the 0.156-in. outside diameter. In addition, overall length is four times the outside diameter. The problem is to drill and form this piece without the part twisting from the bar.

20a-165. Pitfalls to Avoid in Tooling Screw Machines. Part I. Noel Brindle. *Screw Machine Engineering,* v. 9, April 1948, p. 46-50.

The following factors which contribute to the success of many setups; use of two open and opposite turret holes on long parts extending through the turret; indexing the turret only once after severing the part from the bar; nonuse of double index; checking for swing-tool-body interference; checking for cut-down on a lead cam lobe which may result in insufficient turret travel.

20a-166. Stock Ends. *Screw Machine Engineering,* v. 9, April 1948, p. 53.

Revolving Stop, by T. Rehn; Tap Drill Formula, by Foster Marten; Small Drill Bushings, by Charles Heinz; Adjustable Roller-Type Turret Support, by T. Rehn.

20a-167. Diamond Bandsawing. *Aircraft Production,* v. 10, April 1948, p. 129.

High cutting rates on hard materials by use of diamond bandsaw.

20a-168. Specialized Machining. *Aircraft Production,* v. 10, April 1948, p. 141-144.

Details of solution of an unusual problem in boring and drilling which was encountered in production of hydraulic activating units for a British plane.

20a-169. Transfer Machine for Automotive Axle Housings. *Product Engineering,* v. 19, April 1948, p. 96-97.

"Transfermatic" finishes both ends of automotive rear-axle housings at the rate of 152 axles per hour with one operator.

20a-170. Setups for Grinding Milling Cutters. Freeman C. Duston. *Machinery,* v. 54, April 1948, p. 168-173.

Procedures in sharpening milling cutters, end mills, formed cutters,

(Turn to page 44)

METALLURGICAL BOOKS

Eastman Kodak Co., X-Ray Division. **Radiography of Materials.** Company, Rochester, 1943, 96 p.

Glocker, Richard. **Materialprufung mit Röntgenstrahlen unter besonderer Berucksichtigung der Röntgenmetallographie.** Ed. 2, rev. Springer, Berlin, 1936, 386 p.

Guinier, André. **Radiocristallographie.** Dunod, Paris, 1945, 214 p.

Halla, Franz and Mark, Hermann. **Leitfaden fur die röntgenographische Untersuchung von Kristallen.** J. A. Barth, Leipzig, 1937, 354 p.

Hirst, Henry. **X-Rays in Research and Industry.** Chemical Publishing Co., Brooklyn, N. Y., 1943, 127 p.

Hirst, Henry. **X-Rays in Research and Industry.** Ed. 2. Chapman and Hall, Ltd., London, 1946, 124 p.

Low, K. S. **Metallurgical and Industrial Radiology.** I. Pitman & Sons, Ltd., London, 1940, 88 p.

Muncheryan, H. M. **Industrial Radiology and Related Phenomena (X-Rays, Gamma Rays, Physical Metallurgy, and Magnetic Inspection).** Aircraft X-Ray Laboratories, Los Angeles, Calif., 1943, 539 p.

St. John, Ancel and Isenburger, H. R. **Industrial Radiology; X-Rays and Gamma Rays.** Ed. 2. John Wiley & Sons Inc., New York, 1943, 298 p.

Sproull, W. T. **X-Rays in Practice.** McGraw-Hill Book Co., Inc., New York, 1946, 615 p.

Taylor, Abraham. **An Introduction to X-Ray Metallography.** Chapman and Hall, Ltd., London, 1945, 400 p.

Zhdanov, G. S. and Umanskiy, Ya. S. **X-Ray Metallography. Part I.** Ed. 2 (In Russian). Metallurgizdat, Moscow, 1941, 392 p.

Zmeskal, Otto. **Radiographic Inspection of Metals.** Harper and Brothers, New York, 1943 150 p.

B-3. Heat Treating

American Society for Metals. **Age Hardening of Metals.** Society, Cleveland, 1940, 448 p.

American Society for Metals. **Carubrizing.** Society, Cleveland, 1938, 339 p.

American Society for Metals. **Controlled Atmospheres.** Society, Cleveland, 1942, 232 p.

Carnegie-Illinois Steel Corp. **Suiting the Heat Treatment to the Job.** Corporation, Pittsburgh, 1946, 54 p.

DuPont de Nemours, & Co., Inc., E. I. Electrochemicals Dept. **Molten Salt Baths for Heat Treatment and Case Hardening of Steel.** Company, Wilmington, Del., 1942, 71 p.

Grossmann, M. A. **Principles of Heat Treatment.** Ed. 2. American Society for Metals, Cleveland, 1937, 157 p.

Hall, J. J. **Steel Hardening, Tempering and Annealing.** George Newnes, London, 1945, 160 p.

Halvorsen, Halfdan. **Know Your Steel; Assemblage of Data on the Heat Treatments of Steel.** Ed. 3. Author, Detroit, 1941, 109 p.

Homerberg, V. O. **Nitralloy and the Nitriding Process.** Nitralloy Corp., New York, 1942, 40 p.

Jenkins, Ivor. **Controlled Atmospheres For the Heat Treatment of Metals.** Chapman and Hall, Ltd., London, 1946, 532 p.

Koebel, N. K. **Industrial Controlled Atmospheres.** Privately printed for the Lindberg Engineering Co., Chicago, 1941, 71 p.

Krasyuk, B. A. **Case Hardening and Cementation of Steel.** (In Russian) Moscow, 1945, 122 p.

Landau, David. **Nitriding Furnaces.** Nitralloy Corp., New York, 1943, 99 p.

Payson, Peter. **The Annealing of Steel.** Crucible Steel Co. of America, New York, 1944, 59 p.

Portevin, Albert. **Introduction to the Study of Heat Treatment of Metallurgical Products.** Penton Publishing Co., Cleveland, 1939, 246 p.

Samokhotskiy, A. I. **The Aging of Ferrous and Nonferrous Metals.** (In Russian.) Oborongiz, Moscow, 1939, 332 p.

Smet, Gerard de. **La pratique des traitements thermiques des métaux industriels.** Ed. 2. Dunod, Paris, 1942, v. 1.

Winning, John. **Principles and Practices of Heat Treatment.** Emmott and Co., Ltd., Manchester, 1941, 99 p.

Winning, John. **Principles and Practices of Heat Treatment.** Ed. 2. Emmott and Co., Ltd., Manchester, 1945, 108 p.

Winning, John. **Heat Treatment of Metals.** Chemical Publishing Co., Brooklyn, N. Y., 1943, 99 p.

To Be Continued

Eight Basic Atmospheres Described and Compared

Reported by Walter E. Borin

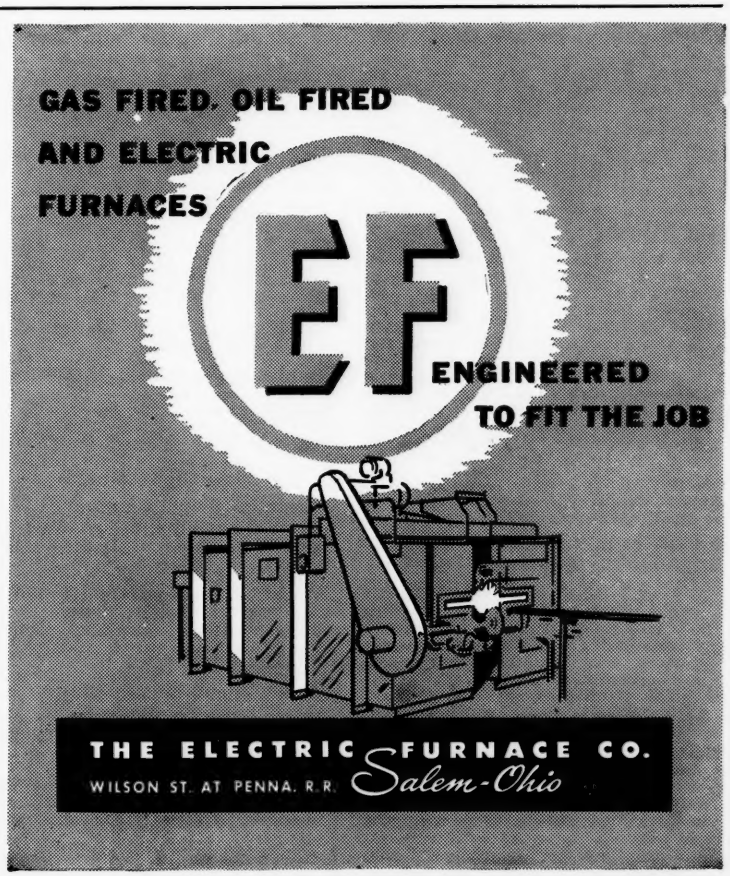
Metallurgist, Underwood Corp.

"Furnace Atmospheres Used During Brazing" was the subject of a talk presented by A. K. Phillippi, manufacturing engineer of the Westinghouse Electric Corp., before the Hartford Chapter A.S.M. on March 9. Mr. Phillippi described methods and equipment for both endothermic and exothermic preparation of atmospheres.

Slides and distributed printed material added detail to the speaker's description of eight basic atmospheres; air-to-gas ratios, atmosphere compositions, use and cost figures were included.

An active discussion followed, during which Mr. Phillippi exhibited many examples of production-run brazed parts. The successful use of controlled atmospheres requires that equipment be kept in the best of condition and be operated with alertness. Due mention was made of toxic and explosive hazards, and methods of ventilation and purging were discussed.

The speaker was introduced by Alden P. Edson, metallurgist, Hamilton Standard Propeller Division of United Aircraft Corp.



and similar tools—second of two articles.

20a-171. High-Speed Cycling. R. H. Clark. *Machine Design,* v. 20, April 1948, p. 101-104.

Use of automatic electric controls in a turret lathe. Special design features reduce inertia of drive, increasing production.

20a-172. "News" on the Production Front. Rex Heath. *Tool Engineer,* v. 20, April 1948, p. 29-34.

New developments in machine tools.

20a-173. Drill Fixture for Machine Tool Headstock. Robert Mawson. *Tool Engineer,* v. 20, April 1948, p. 38.

Ingeniously designed tool for small-lot production of precision parts.

20a-174. Optical Grinding—The Latest Development in Toolmaking. Charles H. Wick. *Machinery,* v. 54, April 1948, p. 154-160.

Extremely accurate profile shapes on parts such as form tools, lamination dies, and templets are being ground quickly and economically by means of optical grinding machines.

20a-175. Broaching Improves Accuracy of Cam Teeth Surfaces. *Production Engineering & Management,* v. 21, April 1948, p. 58.

Application to telephone-relay part having series of cam-shaped slots corresponding to the 10 numbers on a dial phone.

20a-176. The Crib. *Production Engineering & Management,* v. 21, April 1948, p. 73.

Floating Skiving Tool, John H. Hill; and An Adjustable Tracer, J. G. Betz.

20a-177. Grouped Parts Multiple-Machined. F. H. Scriber. *American Machinist,* v. 92, April 8, 1948, p. 90-91.

Four swivel bases are fixtured for simultaneous machining.

20a-178. Practical Ideas. *American Machinist,* v. 92, April 8, 1948, p. 121-126.

Milling machine cuts slotted cams using removable fixtures on table, by Frederick C. Lurz; bar setup on planer to locate trace for turning hourglass shape, by Ralph Egolf; lathe spider to support cylinder on completion of counterboring, by Robert J. Lemp; gage modification for measuring deep, small-diameter holes, by Edward Diskavich; makeshift mike for large work built from discarded snap gage, by George Werner; block gage centers jig borer over edge of work for hole location, by Caris Sorenson; fixture to hold pins for machining both screwdriver and keyway slots at once, by H. Moore; drill shank holds center drill for rapid tailstock assembly, by Allen B. Nixon; and other miscellaneous shop hints.

20a-179. Methods of Driving Straight-Shank Drills. *American Machinist,* v. 92, April 8, 1948, p. 145.

20a-180. High Production Broaching. *Iron Age,* v. 161, April 15, 1948, p. 72-75.

Work which has been done in broaching small stampings and intricately shaped machine parts. By standardizing fixtures, clamping devices, and locaters, these parts are interchangeable on various machines. More than a thousand types of parts are being broached regularly.

20a-181. Carbide Inserts for Single Point Tools. Thomas E. Lloyd. *Iron Age,* v. 161, April 15, 1948, p. 82-83.

Several companies are experimenting with the development. Little information is available concerning the results; advantages which are apparent without such results.

20b—Ferrous

20b-29. Chicago, Burlington & Quincy Diesel Crankshaft Repairs. *Railway Mechanical Engineer,* v. 122, March 1948, p. 67-71.

Combination crankshaft and axle-grinding machine and other equipment used in the shop, and their operation.

20b-30. Gear Specialists. *Western Machinery and Steel World,* v. 39, March 1948, p. 93-95.

Production of gears by Advance Gear Machine Corp., Southern California. Machining and heat-treating operations.

20b-31. The Production of Fuel Pumps for High-Speed Oil Engines. *Machinery* (London), v. 72, March 4, 1948. p. 299-303.

Details of methods used by a British firm.

20b-32. Profile Milling Applied to Accurate Roll Pod Machining. Donald M. Laflin. *Steel,* v. 122, March 29, 1948, p. 72-77, 98.

New machining method centers around use of a specially designed roll holding fixture on a floor-type Giddings & Lewis horizontal boring, drilling, and milling machine equipped with a synchronized, dual, hydraulic, tracer-control attachment. Tungsten-carbide cutters remove metal in roughing operations. Contour milling with a sectional slab mill then gives required accuracy and final finish.

20b-33. New Tools, Close Accuracy Produce Mining, Construction, Oil Equipment. Gerald Eldridge Stedman. *Machine and Tool Blue Book,* v. 44, April 1948, p. 167-168, 170, 172, 174, 176.

Machine-shop equipment and procedures at Gardner-Denver Co., Denver, Colo.

20b-34. Free-Cutting Stainless Steel Castings. *Foundry Trade Journal,* v. 84, March 18, 1948, p. 277.

Limitations of special machining techniques and application to cast products.

20b-35. Machining Coil Slots in Small Stators. *Machinery* (London), v. 72, March 18, 1948, p. 367-368.

Jigs, fixtures, and workholders for production of mild-steel stators.

20b-36. Automatic Broaching Speeds Output of Auto Window Pinions by Pushing Work Through Tool. Herbert Chase. *Steel,* v. 122, April 12, 1948, p. 89.

Method used for production of small steel pinions.

20c—Nonferrous

20c-1. Abrasive Belts for Machining Die Castings. *Die Castings,* v. 6, April 1948, p. 68-70, 72, 74-75.

20d—Light Metals

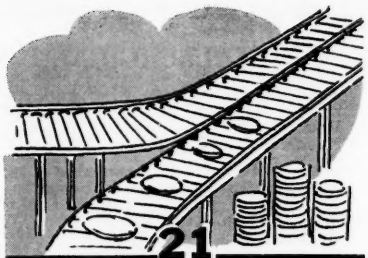
20d-8. Tooling and Production of the Apex Fold-A-Matic Ironer. Part III. Carl F. Benner. *Tool & Die Journal,* v. 14, April 1948, p. 50-54, 65, 75-79.

Design and use of jigs and fixtures for production of the die-cast aluminum gear case, which involves 15 machining operations. Dimensional checking system. (To be continued.)

For additional annotations indexed in other sections, see:

11-87; 19a-65; 22a-88; 24a-83; 27a-41-56.

NEW ENGLAND CARBIDE TOOL CO., INC.
Manufacturers of Precision Carbide Products
Cambridge 39 Massachusetts



21 MISCELLANEOUS FABRICATION

21a—General

21a-51. Continuous Flow Production of Motors. Gordon B. Ashmead. *Western Machinery and Steel World,* v. 39, March 1948, p. 82-85, 118-119, 126.

At A. O. Smith Electrical Mfg. Co., Los Angeles.

21a-52. Giftware. James Corcoran. *Western Machinery and Steel World,* v. 39, March 1948, p. 100-103.

Design and production of fancy metal ware of the type most commonly featured in gift shops, by Saxton, Inc., Los Angeles.

21a-53. Machine-Parts Handling. *Western Machinery and Steel World,* v. 39, March 1948, p. 114.

Solution of a problem involving crankshafts—a solution which can also be applied to the handling of other odd-shaped machine parts.

21a-54. A Very Light Touch! John Gilbert. *Applied Hydraulics,* v. 1, March 1948, p. 17-18, 38.

Use of hydraulic equipment in assembly of small silver contacts and bases.

21a-55. Air-Powered Devices Increase Machine Output. Rupert Le Grand. *American Machinist,* v. 92, March 25, 1948, p. 88-91.

Varied applications.

21a-56. Triple-Acting Press Assembles Stators. H. H. Geimeier. *American Machinist,* v. 92, March 25, 1948, p. 98.

21a-57. Railroad Handling Method Cuts Shipment Costs. *Steel,* v. 122, March 29, 1948, p. 96.

Aluminum truck-trailer body developed by Reynolds Metals. Designed to handle loads up to 20,000 pounds, the units are transported between shippers' loading docks and freight yards on special frames, and are shifted mechanically to standard-type flat cars. At the destination they are shifted back onto trailers and delivered to consignee's door.

21a-58. Ship Repairs at Todd Shipyards. Howard Campbell. *Modern Machine Shop,* v. 20, April 1948, p. 124-128, 130, 132, 134, 136, 138.

Welding, metal spraying, reblading, machine-shop operations, sheet-metal work, and inspection practices.

21a-59. Modernization Program Ends Fabricating Shop Bottlenecks. W. G. Paton. *Iron Age,* v. 161, April 1, 1948, p. 86-89.

How combining modern materials-handling techniques with improved plant layout had enabled Austin Co. to meet mounting production costs and increase output.

21a-60. Fabricated Electric Motors. *Machinery* (London), v. 72, Feb. 19, 1948, p. 237-242.

Fabrication methods used by a British firm. Press work and assembly.

21a-61. Radiator Cores. *Automobile Engineer,* v. 38, March 1948, p. 93-96.

Semi-automatic assembly machine.

(Turn to page 46)

Points Out Relationships of A.S.M. and Metal Industry

Reported by C. G. Atchinson
Assistant Chief Metallurgist
Sheffield Steel Corp.

The American Society for Metals, an organization of some 20,000 people interested in metals, is made up mainly of representatives from the technical, executive, sales and student groups. Each group can benefit through the organization, but they all have a big obligation toward the metal industries, Arthur E. Focke, trustee of the national society, and chief metallurgist of the Diamond Chain Co., told the members of the Kansas City Chapter at its annual National Officers and Sustainers Night. Dr. Focke's subject was "The Metallurgist, the A.S.M. and the Metal Industry".

The very existence of A.S.M. is dependent on the help of industry, he pointed out, because it pays, mainly through advertising, the wide difference between the cost of services rendered by the national society and the amount collected as dues. Industry also furnishes most of the speakers, without cost, for the local chapters. Sustaining memberships are vital to the growth and success of the local chapters.

In return, industry has a right to expect a reasonable return from the money and encouragement it has given A.S.M. One of the most important of these is assurance of a steady supply of fresh metallurgical talent. Local chapters can help meet this obligation by furnishing qualified speakers to appear before high school groups and persuade outstanding young people to choose metallurgy as a vocation. Subscriptions to *Metal Progress* for the high school libraries is also effective.

Industry also expects A.S.M. to help its employees to keep abreast of the latest metallurgical developments. Educational courses taught by qualified members is the most effective way the local chapters can meet this obligation.

Copper Alloy Uses Described

Reported by Gene P. Davis
Metallurgist, Warner Gear Div., Borg-Warner Corp.

W. S. Girvin, assistant metallurgist, American Brass Co., Waterbury, Conn., spoke before the Muncie Chapter at its February meeting on the subject of "Copper and Copper Alloys". A technicolor film entitled "Copper", filmed by Anaconda, gave a complete story of the processes involved in the mining and refining of the valuable ore.

Introduced by Technical Chairman Perry House, Mr. Girvin described in detail the various alloys of copper and cited specific uses for which each is best used.

Present at Kansas City's National Officers and Sustainers Night Were (Left to right): Clyde Atchinson, Past Chairman; Fred Funk, Member of the Executive Committee; Milo Stutzman, Chairman; Glen Young, Secretary-Treasurer; Arthur Focke, A. S. M. National Trustee and Speaker; F. A. McCoy, Founding Chairman; Hugh Springer, Entertainment Chairman; and Henry Beeson, Membership Chairman

Sauveur Night Speaker Traces History Of Isothermal Transformation of Steel

Reported by Howard J. Godfrey
Assistant Chief Development Engineer
John A. Roebling's Sons Co.

The memory of Albert Sauveur was honored again by the Philadelphia Chapter A.S.M. at its 15th Annual Sauveur Night, on March 19. Edmund S. Davenport, assistant to vice-president, research and technology, U. S. Steel Corp., spoke, appropriately, on "Isothermal Transformation of Steel".

Dr. Sauveur visited the U. S. Steel Research Laboratory in July 1938, Mr. Davenport recounted, and participated in a round-table discussion on the isothermal transformation results published up to that time. The ideas presented by the laboratory staff were not entirely accepted by Dr. Sauveur. Mr. Davenport illustrated this portion of his talk with a couple of excellent likenesses of Dr. Sauveur, one taken during the discussion at the Laboratory.

The speaker described the method of obtaining S-curves, now known as I-T or TTT-curves. The metallographic method, he said, is the best means of determining these curves. The initial experiments were made in 1929. At that time no photomicrographs were made of the samples used. In 1944, however, to complete the studies as a matter of historical interest, a search of the files was made and the original test specimens were found. Photomicrographs were then made of the series that originally had been studied 15 years earlier. The metallographic method thus furnishes a permanent record for subsequent check or investigation.

Mr. Davenport reviewed the isothermal transformation curves of a wide variety of carbon and alloy steels. All alloys with the exception of cobalt slow down the isothermal transformation of steel. There is no satisfactory explanation for the effect of cobalt at the present time.

The speaker illustrated how the properties obtained by various heat treatments can be explained by the I-T curves. In addition to the alloy effect on the rate of isothermal transformation, he showed how an increase in grain size tends to slow down the rate of transformation particularly in the upper region of the curve. Undissolved carbides, on the other hand, tend to increase the rate of transformation.

Following the lecture Mr. Davenport was presented with a certificate as 15th Sauveur lecturer.

Bibliography Pool Assembled

Numerous rare and unpublished bibliographies on scientific and technical subjects are now available to industry as the result of the formation of a pool of unpublished bibliographies by the Special Libraries Association. Typical of the compilations available are bibliographies on portable prefabricated bridges, 1930-1944; centrifugal casting, 1910-1942; welding and fabrication of clad steels, 1907-1946.

The pool is housed in the library of Battelle Institute, Columbus, Ohio, from which loans of the bibliographies are made. Anyone interested in obtaining the complete listing of the bibliographies should write Ralph H. Hopp, technical librarian at Battelle, who serves as chairman of the S.L.A. Bibliography Committee.

21a-62. Motor Cars for Export. *Machinery* (London), v. 72, March 11, 1948, p. 331-341.

Equipment and procedures in production of Austin cars in Britain. Production of valves and rear-axle housings, especially machining operations.

21a-63. Metallized Circuits. John T. Collier. *Product Engineering,* v. 19, April 1948, p. 141-143.

New technique for mass production of electrical circuits using metal spraying through a stencil. Advantages and costs.

21a-64. Monorail Raises Production of Screw Machines. M. M. Roberts. *Factory Management and Maintenance,* v. 106, April 1948, p. 75.

21a-65. Buick's Dynaflow Drive Built to Aircraft Tolerances. Charles H. Wick. *Machinery,* v. 54, April 1948, p. 135-142.

Processes developed to meet unusual problems encountered in producing this unit economically on a mass-production basis.

21a-66. Curved Chutes Aid Work Ejection. Harry S. Wharen. *American Machinist,* v. 92, April 8, 1948, p. 88-89.

Handling equipment for removing electric-motor rotor and stator laminations from five-stage progressive die.

21a-67. Pistons and Con Rods Machine-Assembled. Chester S. Ricker. *American Machinist,* v. 92, April 8, 1948, p. 111.

A new machine is used.

21a-68. Pneumatic Chip Conveying Centralizes Storage, Reduces Costs and Eliminates Accidents. H. M. Nichols. *Steel,* v. 122, April 19, 1948, p. 81-82, 84.

21a-69. Overhead Carrier System Streamlines Material Flow at J. & L.'s Wire Plant. *Steel,* v. 122, April 19, 1948, p. 92, 94.

21b—Ferrous

21b-29. Plymouth's Unique Conveyers. *SAE Journal,* v. 56, March 1948, p. 29-34. Excerpts from "Material Handling-Conveyers", by John vonRosen.

Unusual methods used in assembly of Plymouth automobiles.

21b-30. Raw Materials Handling in the Steelworks Storage Yard. Frank C. Wier. *Steel,* v. 122, March 29, 1948, p. 101, 104, 107, 110, 112.

21b-31. Sachkenntnis. *Industrial and Engineering Chemistry,* v. 40, April 1948, p. 7A, 10A.

The title is a German word corresponding to the American "know-how". Several ingenious and unique German fabrication techniques displayed at the Bureau of Mines' coal-liquefaction experiment station, Louisiana, Mo., are briefly described. The most interesting is the "Wickelofen", a 61-ton heat-exchanger unit tested to withstand 910 atmospheric pressure, whose main cylinder is a steel tube of less than 1-in. thickness, spirally wound with 14 layers of 79 x 8-mm. corrugated steel tape. This tape is applied at 800-900° C., using a special lathe, and is quenched immediately to create continuous stress which increases the strength of the finished tube 54% over that of a solid tube of similar size. The most significant advantage is ease of fabrication over conventional forging. The unit was widely used in ammonia, methanol, and hydrogenation units.

21b-32. Hudson Final Assembly Layout Quite Different Than Others. Joseph Geschelin. *Automotive Industries,* v. 98, April 1, 1948, p. 28-29, 60.

With introduction of its new Monobilt body—a structure combining the body and frame in an integral unit—Hudson found it necessary to develop special techniques for fabrication and to make a complete revision of its final car-assembly procedures.

21b-33. Applying Continuous Steel Sheathing to Electric Cable. *Machinery* (London), v. 72, Feb. 19, 1948, p. 245-246. Based on B.I.O.S. Report No. 1570.

Ingenious method developed in Germany. The material, in the form of steel strip, is drawn from a reel, wrapped into tubular form, and welded longitudinally between an outer roller electrode and an inner tubular electrode surrounding the cable core. A length of seam is welded while the inner electrode moves forward with the outer sheathing. Then the welding current is switched off, and the inner electrode returns to its starting position ready for the next welding traverse. Meanwhile, continuous corrugations are being rolled in the welded sheathing.

21b-34. Double Duty "Reefers" for 100 M.P.H. Service. *Inco,* v. 22, Spring 1948, p. 4-7.

Production of refrigerator cars from low-alloy steel.

21b-35. Mechanical Toy Production. *Machinery* (London), v. 72, March 18, 1948, p. 369-373.

Production of steel toy horses involves design, welding, finishing, materials handling, and plant layout.

21b-36. Special-Purpose Tools Boost Steel Spring Production. *Production Engineering & Management,* v. 21, April 1948, p. 67-69.

21b-37. New Development in Tin-Plate Manufacture. E. F. Harris. *Steel,* v. 122, April 12, 1948, p. 94, 96. A condensation.

New handling methods and equipment. (Presented at A.S.M.E. meeting, New Orleans, March 1-5, 1948.)

21c—Nonferrous

21c-5. Expanded—for Economy. *Inco,* v. 22, Spring 1948, p. 10-11.

Manufacture of "expanded" Ni-alloy screens. This type of screen is made by slitting sheets of the material to be used, then stretching and roller flattening.

21d—Light Metals

21d-3. Alvis Leonides Design Details; Batch Production of Major Components. J. A. Oates. *Aircraft Production,* v. 10, April 1948, p. 132-138.

Production of the British radial aircraft engine, including foundry work on light-alloy parts; welding; machining; and assembly operations.

For additional annotations indexed in other sections, see:

3b-41; 20a-162; 24b-48.

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JOINING and FLAME CUTTING

22a—General

22a-75. Stability of the Power Source for the Electric Arc During Welding. (In Russian.) V. P. Nikitin. *Avtogennoe Delo* (Welding), Nov. 1947, p. 13-15.

Mathematical calculations for determination of conditions. The equations are interpreted graphically.

22a-76. X-Ray Investigation of the Welding-Arc Zone, While Operating Under Flux. (In Russian.) N. G. Ostapenko and B. I. Medovar. *Avtogennoe Delo* (Welding), Nov. 1947, p. 16-20.

An apparatus for the investigation and typical results. Determination of the ratio between the part of the arc submerged in the base metal and the part outside and adjacent to the electrode. This ratio is believed to be related to factors affecting the quality of the welds.

22a-77. The "Elasticity" of a Welding Arc Formed Under Flux. (In Russian.) N. G. Ostapenko. *Avtogennoe Delo* (Welding), Dec. 1947, p. 5-8.

Ability to decrease or increase the arc length without interruption—that is, stability. The absolute value of the length is shown to be related to chemical composition of the flux. The induction of the welding circuit influences the maximum arc length only slightly.

22a-78. Methods of Control of Spot Welding. (In Russian.) O. S. Balkovets. *Avtogennoe Delo* (Welding), Dec. 1947, p. 9-14.

Incomplete penetration may be detected nondestructively only during transition into the fused state. It may be detected and prevented only by direct control of temperature conditions in the weld zone or by observation of accompanying volumetric changes. A dilatometric method for the latter is proposed. 14 ref.

22a-79. Metal to Wood Bonding. Jac. H. Tigelaar. *Proceedings of the First National Meeting, Forest Products Research Society* Madison, Wis., 1948, p. 87-94; discussion, p. 94.

Adhesive bonding of a thin sheet of metal to wood or plywood, forming a product known as "Plymetl". Comparative stiffness factors of sheet aluminum, sheet steel, plywood, and plywood faced on one and on both sides with metal. Various bonding methods. 18 ref.

22a-80. Soot-Blower Jet Tubes Manufactured by Arc Welding. E. F. Gill. *Welding,* v. 16, Feb. 1948, p. 48-52.

Described and illustrated.

22a-81. Argonarc Welding; A Review of Progress. R. R. Sillifant. *Welding,* v. 16, Feb. 1948, p. 53-60.

Surveys historical development of argonarc process and traces progress of work both in the U. S. A. and in Great Britain. Line of future advances. 24 ref.

22a-82. Resistance Welding in Mass

(Turn to page 48)

Quenching and Tempering Oil Selection Related to Heat Treat Requirements

Reported by Louis Malpocker
Lincoln Engineering Co.

The relationships between the heat treating requirements of the metal being processed, the quenching or tempering system, and the characteristics of the quenching or tempering oil were clarified by E. B. Fremon, chief engineer, technical department, Socony Vacuum Oil Co., Inc., Lubrite Division, in a talk on "Quenching and Tempering Oils" at the March meeting of the St. Louis Chapter A.S.M. Mr. Fremon considered quenching oils and tempering oils separately.

Selection of a quenching medium many times depends upon the type of steel being treated. When two or more quenching mediums are equally suitable, cost should be the determining factor. The entire subject of quenching mediums has been greatly broadened in the past 15 years by new knowledge of the mechanism of hardening, particularly information supplied by S-curves and other hardenability data.

The primary purpose of quenching, Mr. Fremon stated, is to remove heat from the piece fast enough so that the transformation from austenite to martensite will take place. The effects of various cooling rates on the final structure of a steel were illustrated by a slide in which a cooling curve for several quenching mediums was superimposed upon the S-curve of the steel to be quenched.

Pictures Show Quenching Stages

In oil quenching, cooling takes place in three distinct stages, known as the vapor blanket stage, the vapor transport stage, and the liquid cooling stage. Pictures by Zavarine showed a specimen quenched in oil and the reactions in the three stages. Heat transfer in the first stage is quite slow. In the vapor transport stage, heat is transferred away from the piece quite rapidly. The liquid cooling stage is also slow unless there is extremely rapid circulation of the oil.

The factors which influence the quenching speed of oil are (a) quenching temperature, (b) size and shape of part being quenched, (c) composition of the quenching oil, (d) effect of decomposition of the oil, (e) temperature of the oil.

Full consideration of the requirements in the light of quenching speed, chemical stability, flash point, and viscosity, both by qualified people in the user's plant and by the oil supplier, will result in the selection of a satisfactory oil on the basis of price and performance.

Tempering oils may be used up to 600° F., but Mr. Fremon stated that temperatures under 500° F. are preferable in service. The primary requirements of a tempering oil are high flash point and good chemical stability.

Some of the pointers on the use of quenching and tempering oils brought out by Mr. Fremon are as follows:

1. Life of a quenching or tempering oil depends upon operating conditions.
2. Provisions should be made for adequate cooling of quenching oil, in systems where large amounts of steel are handled.
3. Oils should be filtered to prevent sludge formation, if cost permits.
4. When quenching cyanide parts, straight mineral oils should be used to prevent the formation of soap.
5. In the design of a heating system for tempering oil, every effort should be made to secure the proper oil temperature without too high a temperature at the heat source; otherwise, coke or "carbon" will form.
6. A check should be made for water in the quenching oil system from time to time, and if present it should be removed.

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The seminar was arranged by Dr. George Sachs, of Case Institute of Technology. The scope and importance of this fine work may be measured by this list of chapters and authors.

CONTENTS

General Introduction, by Dr. George Sachs; The Micro-Mechanism of Fracture, by Clarence Zener, University of Chicago; Effect of Stress State on Fracture Strength of Metals, by J. E. Dorn, University of California; Effect of Strain on Fracture, by George Sachs, Case Institute of Technology; Fracture and Strength of Metals, by J. H. Hollomon, General Electric Co.; Metallurgical Aspects of Brittle Fracture Phenomena in Mild Steels, by I. G. Slater, British Admiralty Delegation; Effect of Section Size on Fracture, by E. R. Parker, University of California; Fracture Dynamics, by George Irwin, Naval Research Laboratory; Evaluation for Structural Design of Laboratory Data on Flow and Fracture of Steel, by W. P. Roop, Swarthmore College; Size Effects in Steels and Other Metals from Slow Notch Bend Tests, by P. Shearin, North Carolina University; Fracture and Hydrostatic Pressure, by P. W. Bridgman, Harvard University; Notch Tensile Testing, by J. D. Lubahn, General Electric Co.; Report on Conference on Mechanical Properties of Solids at the University of Bristol, by N. F. R. Nabarro, Naval Research Laboratory; New Testing Machines for Combined Stress Experiments, by J. Marin, Pennsylvania State College; Speed of Propagation of Fracture Cracks, by E. Saibel, Carnegie Institute of Technology; Application of Dislocation Theory to Fracturing by Fatigue by E. S. Machlin, National Advisory Committee for Aeronautics; Experimental Plans for Study of the Laws Governing Primary Deviation from Elastic Behavior of Materials under Triaxial Stresses, by L. H. Donnell, Illinois Institute of Technology; Plastic Flow and Rupture of Steel at High Leads by T. A. Read, Oak Ridge National Lab., and H. Markus and J. M. McCaughey, Frankfort Arsenal. Theory of Static Fatigue for Brittle Solids, by E. F. Poncelet, Owens-Illinois Glass Co. Summary, by Prof. Roop.

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Production; Electrodes and Jigs for Hot Riveting. A. J. Hipperson and T. Watson. *Welding*, v. 16, Feb. 1948, p. 76-80.

Types of electrodes and design of jigs.

22a-83. Welding in the Development of Jet Propulsion Engines. H. E. Lardge. *Transactions of the Institute of Welding*, v. 2, Feb. 1948, p. 15-24.

The part played by various welding and allied processes in the manufacture and development of sheet metal work for engines with single-stage centrifugal compressors and single-stage turbines. Various welded assemblies are illustrated. (Presented to meeting of Institute of Welding, London, Feb. 26, 1948.)

22a-84. Review of Flame Cutting Developments Past, Present and Future. R. E. Dore. *Transactions of the Institute of Welding*, v. 2, Feb. 1948, p. 25-34.

(Presented to North London Branch, Institute of Welding, March 10, 1947.)

22a-85. Accumulator Applications to Welding Equipment. H. A. Vander Kaay. *Applied Hydraulics*, v. 1, Feb. 1948, p. 22-23, 32.

Use of pressure accumulators in hydraulic systems.

22a-86. Bonding of Thin Metal Sheets by Synthetic Resin Adhesives. Francis A. Westbrook. *Machinery Lloyd* (Overseas Edition), v. 20, Feb. 28, 1948, p. 74-78.

The two basic principles of adhesion—mechanical and specific. Outlines the process and presents comparative data on shear strength of Alclad joints made with Redux adhesive alone, with rivets alone, and with a combination of the two, for two thicknesses and after different exposure periods and conditions. Strengths of joints between various metal combinations; and ultimate shear strengths of Redux joints for various overlaps and metal thicknesses.

22a-87. Inert-Gas Shielded-Arc Welding Broadens Its Applications. H. O. Jones and H. A. Huff, Jr. *American Machinist*, v. 92, March 25, 1948, p. 92-95.

For hard-to-weld metals, as well as for special applications on ordinary materials, Heliwelding is highly efficacious.

22a-88. Producing Diesel Engine Turbosuperchargers. F. R. Ericson. *Iron Age*, v. 161, March 25, 1948, p. 72-77.

Step-by-step description of the fixturing and welding of the turbine parts, including the high-temperature alloy buckets, shows the accuracy to which welded fabrications can be held. The milling operations in producing the buckets from solid bar stock.

22a-89. Running Your Own Shop? Part II. Ray T. Nicholas. *Industry and Welding*, v. 21, April 1948, p. 38-40, 42.

The importance of good equipment and the variety required for a welding job shop. Also discusses the hiring and training of personnel.

22a-90. Fabrication of a Steam-Heated Copper Roll. *Welder*, v. 17, Jan.-March 1948, p. 4-6.

Required welding of copper to mild steel.

22a-91. Fabrication as Applied to Switchgear. A. E. Fawcett. *Welder*, v. 17, Jan.-March 1948, p. 7-10.

Fabrication of large electrical switches.

22a-93. Electric Arc Welding as Applied to Trackwork. N. W. Swinnerton. *Welder*, v. 17, Jan.-March 1948, p. 11-13.

22a-93. Spotlight on Arc Welding. Part III. Edwin Danks & Company (Oldbury) Limited, Oldbury, Staffs. *Welder*, v. 17, Jan.-March 1948, p. 14-17.

Procedures and equipment of above British firm for manufacture of heavy tanks.

22a-94. E. F. B. Fred M. Burt. *Welding Engineer*, v. 33, April 1948, p. 40-43.

Electric-furnace brazing, to join steel stampings and other components into various parts. Advantages and procedures of the process.

22a-95. Welding the Giants. L. J. McDonough. *Welding Engineer*, v. 33, April 1948, p. 51-53.

Facts on reducing production costs of heavy machinery through use of arc welding.

22a-96. New Tricks Learned in Railroad Maintenance. Arthur L. Havens. *Welding Engineer*, v. 33, April 1948, p. 54-57.

How flame cutting and welding are being used in a locomotive repair shop.

22a-97. Spot Welded Window Screens. Walter Rudolph. *Welding Engineer*, v. 33, April 1948, p. 59.

Use of spot and projection welding in mass production of screen and storm sash.

22a-98. Railroads and the American Welding Society. L. E. Grant. *Railway Mechanical Engineer*, v. 122, April 1948, p. 76-77.

Relations between the Society, which has been largely responsible for advance of welding techniques and expansion of applications, and the railroads which have long benefited from the art.

22a-99. How Brazing Methods Affect Design of Details. S. DeDomenico and A. Squire. *Product Engineering*, v. 19, April 1948, p. 86-91.

Comparison of different techniques of torch, resistance, bath, furnace, and induction brazing. Method used affects selection of materials, design of details, and properties of brazed joints.

22a-100. The Story of Welding. W. P. Gillingham. *Compressed Air Magazine*, v. 53, April 1948, p. 78-84.

Historical, but with major emphasis on recent developments.

22a-101. Kinetic-Energy Storage for Resistance Welding. Thomas J. Crawford. *Welding Engineer*, v. 33, April 1948, p. 36-39.

A new system of d.c. supply for spot, projection, or flash welding.

22a-102. Resistance Welding in Mass Production; Flash and Butt Welding Principles. A. J. Hipperson and T. Watson. *Welding*, v. 16, March 1948, p. 121-125.

One of a series of review articles.

22b—Ferrous

22b-100. Electrodes of High Efficiency for Manual Arc Welding. (In Russian.) A. M. Gofner, V. I. Kuznetsov, M. I. Kunis, and N. N. Kryukovskii. *Avtogennoe Delo* (Welding), Nov. 1947, p. 21-23.

Powdered steel as a component of electrode coatings increases the efficiency considerably. Preparation method is similar to those commonly used.

22b-101. Deformation of Welded T-Shaped Bars. (In Russian.) N. O. Okerblom. *Avtogennoe Delo* (Welding), Dec. 1947, p. 1-5.

Development of relationships between longitudinal deformation, cross-sectional area, geometry, and conditions of welding.

22b-102. Applicability of Automatic Structural Welding of Low-Carbon Steels at Low Temperatures. (In Russian.) B. I. Medovar and A. E. Asnis. *Avtogennoe Delo* (Welding), Dec. 1947, p. 15-17.

Testing of a specimen welded under normal conditions and one welded at −20° C. showed 15 to 20% lower impact strength of the latter. However, cold brittleness was not increased.

22b-103. Cold Brittleness of Welded Structures at Low Temperatures. (In Russian.) A. S. Ogievetskii. *Avtogennoe Delo* (Welding), Dec. 1947, p. 18-19.

Factors causing the cold brittleness and a series of remedies.

22b-104. Gas Pressure Welding in the Construction of Pipelines. (In Russian.) A. S. Fal'kevich. *Avtogennoe Delo* (Welding), Dec. 1947, p. 20-24.

Equipment and procedures.

22b-105. Fusion Welding and Cutting as Used With Design, Fabrication, and Maintenance of Steam Locomotive Boilers and Tenders. *Master Boiler Makers' Association, Official Proceedings of the 1947 Annual Meeting*, 1947, p. 74-82; discussion, p. 82-90.

A committee report.

22b-106. Fusion Welding and Cutting as Used With Design, Fabrication, and Maintenance of Steam Locomotives, Boilers and Tenders. Willard K. Fohl. *Master Boiler Makers' Association, Official Proceedings of the 1947 Annual Meeting*, 1947, p. 91-93; discussion, p. 93-101.

Data on welding properties of Ni steel, C-Mo steel, Mn-V steel, and Si-Mn steel.

22b-107. Examen General du Probleme des Tensions Internes de Soudure. (General Examination of the Problem of Internal Welding Pressures From the Point of View of Their Elimination or Utilization.) E. Varriot. *Soudure et Techniques Connexes*, v. 2, Jan.-Feb. 1948, p. 12-16.

The theory and the possibility of using them to improve the resistance of steels.

22b-108. Carbon and Alloy Steels; Factors Governing Their Weldability. Part 2. T. L. H. Butterfield. *Welding*, v. 16, Feb. 1948, p. 61-66.

Thermal effects; hardenability curves as a guide to weldability; use of S-curves; various tests for evaluating weldability.

22b-109. Factors in Production Control of Arc Welding. D. M. Kerr, *Transactions of the Institute of Welding*, v. 2, Feb. 1948, p. 35-42.

Various factors are tabulated, charted, and discussed, especially as applied to manual arc welding. (Presented at meeting of West of Scotland Branch, Institute of Welding, Glasgow, Nov. 1946.)

22b-110. Three-Part Refrigerator Liners Joined in One Operation. *Steel*, v. 122, March 29, 1948, p. 78.

Production of 20-gage steel, food-compartment liners in the plant of Seeger Refrigerator Co., St. Paul, runs between 90 to 180 units per hour since installation of welder.

22b-111. That New Look in Boiler Shops. John A. Weaber, Jr. *Industry and Welding*, v. 21, April 1948, p. 26-29, 56.

Substitution of welding for riveting by Union Boiler and Mfg. Co., Lebanon, Pa., on stainless as well as carbon steel.

22b-112. Profitable Brazing Application. S. Griswold Flagg. *Industry and Welding*, v. 21, April 1948, p. 45, 48-49

Development of threadless malleable fittings for small-diameter piping installations.

22b-113. Welds on Cast Iron. H. Seymour. *Mining Magazine*, v. 78, March 1948, p. 142-143.

22b-114. Ryan Welding Innovations. William P. Brotherton. *Western Ma-*

(Turn to page 50)

Embarrassing Aspects Of Quench Cracking In Steels Unmasked

Reported by H. L. Millar

The economic importance of understanding the underlying reasons for the development of cracks in quenching steels was emphasized in a talk by G. E. Brumbach, metallurgical engineer of the Carpenter Steel Co., before members of the Los Angeles A.S.M. on Feb. 26.

Mr. Brumbach emphasized the stringent changes which a section of toolsteel undergoes in the first few seconds after the hot steel is immersed in the quenching medium (especially water and, to a lesser extent, oil). At this specific period there is a definite temperature gradient between the surface and the interior of the piece of toolsteel, and if the heat treater understands this phenomenon he can often handle the tool in such a way that the stresses which are set up—and which tend to cause the cracking—can be made useful rather than destructive. That design of dies and other tools definitely affects the results attained was shown by means of several slides.

Martempering is becoming increasingly popular in the heat treatment of toolsteels, Mr. Brumbach mentioned. However, this practice is not often applied to water hardening steels; and with oil hardening tools, size limitations of 2 to 2½ in. maximum thickness are generally observed. Air hardening toolsteel, on the other hand, can be martempered in very large sections.

The relatively modern technique of deep freezing of tools, the speaker explained, is applied to steels subject to retained austenite after heat treatment; it is helpful in completing the transformation.

Advantages of air hardening steels (particularly for intricate designs or difficult sections) include (a) reduction of stresses in hardening, (b) elimination or at least reducing distortion during the hardening process, and (c) definite reduction of the tendency toward cracking.

The speaker showed graphically the absence of temperature gradients in the air cooling of various size rounds and its interpretation in terms of actual tools.

Mr. Brumbach's excellent selection of slides added materially to his instructive talk.

Federated Metals Host To Penn State Students

Federated Metals Division, American Smelting and Refining Co., was host recently at both its Perth Amboy and Newark, N. J., plants, to a group of 25 engineering students from Pennsylvania State College.

At Perth Amboy the students inspected the manufacture of brass, bronze and aluminum ingot, and toured the modern research laboratories. At Newark they observed the manufacture of solder, babbitt, type metal and zinc-base die-casting alloys. Professors H. M. Davis and H. J. Read of Pennsylvania State College were in charge of the student group, and W. T. Battis, plant superintendent at Perth Amboy, was host for the company. At Newark, the students were escorted by Fred J. Menninger.

Brumbach Speaks on West Coast

Los Angeles Chapter Officials at February Meeting (Left to Right): Prof. M. Asimow, University of California, Technical Chairman; E. R. Babylon, Kaiser Co., Inc., Chapter Vice-Chairman; George E. Brumbach, Carpenter Steel Co., the Speaker; and Edgar Brooker, U. S. Spring & Bumper Co., Chapter Chairman

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METAL FINISHING CHEMICALS

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chinery and Steel World, v. 39, March 1948, p. 106-110.

Some of the unusual methods developed by Ryan Aeronautical Co. for fabrication of stainless-steel aviation exhaust systems.

22b-115. Fontana Pipe Mill. *Western Machinery and Steel World,* v. 39, March 1948, p. 113.

Kaiser's new mill which will turn out 90,000 to 125,000 tons of pipe annually in sizes ranging from ½ to 4 in. in diameter. Pipe is produced by shaping and welding.

22b-116. Electric Arc Welding Against Pressure. D. K. Stephens. *Petroleum Engineer,* v. 19, March 1948, p. 141-142, 145.

Method used by Panhandle Eastern Pipe Line Co. for welding its natural-gas lines.

22b-117. Saving Weight in a Diesel's Welded Underframe. Leonard Pompa. *Railway Mechanical Engineer,* v. 122, March 1948, p. 61-63.

The redesign and fabrication of a 2000-hp. diesel-electric locomotive underframe which resulted in a 12,000-lb. weight saving.

22b-118. An All-Welded Hopper Wagon. *Welder,* v. 17, Jan.-March 1948, p. 2-4.

British railroad hopper car.

22b-119. Stainless Steel Lining of Vessels. *Welder,* v. 17, Jan.-March 1948, p. 20-22.

Techniques used in relining some vessels.

22b-120. An All-Welded Steel Water Tower. *Welder,* v. 17, Jan.-March 1948, p. 17-18.

Structural details.

22b-121. British Shipbuilding—Part 5. Developments at Cammell Laird & Co., Ltd.. *Welding,* v. 16, March 1948, p. 98-105.

Development of welding in these yards and present activities.

22b-122. Carbon and Alloy Steels; Factors Governing Their Weldability. T. L. H. Butterfield. *Welding,* v. 16, March 1948, p. 113-120.

This third section discusses the relationship of maximum hardness and hardenability to weldability. Rigid butt-joint test data for a series of steels.

22b-123. Fabricated Bakery Equipment; Details of Welded Design. A. K. Johannesen. *Welding,* v. 16, March 1948, p. 126-128.

22b-124. The Stainless Steels. Part V-A. Welding of the Stainless Steel Compositions. Lester F. Spencer. *Steel Processing,* v. 34, April 1948, p. 198-203, 218.

19 ref.

22b-125. The Powder Process in Stainless Steel Production. C. J. Burch and E. M. Holub. *Blast Furnace and Steel Plant* v. 36, April 1948, p. 443-446. A conversation.

Methods, apparatus, and applications, with particular reference to flame cutting. (Presented at the Annual Meeting A.I.S.E., Pittsburgh, Sept. 23-25, 1947.)

22b-126. 292-Ft. All-Steel Reservoir. A. N. Carter. *Welding Engineer,* v. 33, April 1948, p. 33-35, 39.

Construction of a ten-million gallon covered steel reservoir with an all-welded shell.

22b-127. Torch-Brazed Pipe Fittings. Clyde B. Clason. *Welding Engineer,* v. 33, April 1948, p. 45.

How socket-type pipe fittings of black malleable iron now enable steel or wrought-iron pipe to be joined economically by silver brazing.

22b-128. Automatic Hard Facing. H. W. Sharp. *Welding Engineer,* v. 33, April 1948, p. 46-48.

How hard facing electrodes are now made in the form of continuous steel-tube coils containing various alloying elements.

22b-129. Making a Point by Pulling Teeth. David Sciaky. *Applied Hydraulics,* v. 1, April 1948, p. 14-15, 18

An unconventional use of a resistance welding machine equipped with air clamping and locating cylinders to form harrow-tooth profiles.

22b-130. Methods of Joining Cast Iron Pipe. (Concluded.) J. E. York. *Heating and Ventilating,* v. 45, April 1948, p. 86-90.

Couplings, clamps, and saddle joints for cast-iron and steel pipe and flanged joints for cast-iron pipe.

22b-131. How to Repair Leaks by Arc Welding When Fluid Crackers Are in Operation. Robert H. Darling. *Petroleum Processing,* v. 3, April 1948, p. 349-350.

Techniques used.

22b-132. More Output and Less Cost With Well-Planned Fixtures. Clarence H. Hopper. *Production Engineering & Management,* v. 21, April 1948, p. 55-57.

How substantial savings in the cost of fabricating tubular bus-seat frames have been made at Oneida Products by use of improved welding fixtures.

22b-133. Arc Welding Stainless Impellers. Walter L. Elliott and George Handyside. *Steel,* v. 122, April 12, 1948, p. 82-84.

Technique which is claimed to have succeeded in retaining all the corrosion-resistant properties of the parent metal, producing a weld with equal corrosion-resistant properties, and at the same time preventing failure at the joint and keeping distortion to a minimum.

22b-134. Conversion From Spot to Butt Joining Steps Up Wrench Production. *Steel,* v. 122, April 19, 1948, p. 98.

22c—Nonferrous

22c-9. Hard Soldering of Thin Brass Sheets Using a Spot Welding Machine. (In Russian.) A. S. Rudakov and V. M. Shakhmatov. *Avtogennoe Delo* (Welding), Dec. 1947, p. 24-27.

Method for adaptation of the equipment to this job.

22c-10. The Welding of Nonferrous Metals—Part X. The Welding of Lead and Its Alloys. E. G. West. *Sheet Metal Industries,* v. 25, March 1948, p. 563-573.

Series to be continued.

22c-11. Limb-Lopper Assembled by Induction. *Western Machinery and Steel World,* v. 39, March 1948, p. 90-92.

The "Limb-Lopper" is an air-actuated pruning tool made in Los Angeles by Miller-Robinson Co. by brazing assembly of simple parts.

22d—Light Metals

22d-15. Le Probleme des Soufflures dans la Soudure des Alliages Légers. (The Problem of Bubbles in the Welding of Light Alloys.) J. Herenguel. *Soudure et Techniques Connexes,* v. 2, Jan.-Feb. 1948, p. 5-11.

Factors involved in swelling due to bubbles close to the welded joint. It is suggested that control of swelling may be maintained by changes in composition of metal, gas content, conditions of hardening, and transformations.

22d-16. Flame-Brazed Joints in Aluminum Busbar and Their Radiographic Examination. Part III. F. Clark and F. P. Vickers. *Welding,* v. 16, Feb. 1948, p. 67-75, 80.

Development work on the brazing of aluminum bars up to ½ in. such as are used in electrical circuits. Details of radiographic technique. (Concluded.)

22d-17. Resistance Welding of Light Alloys. E. J. Keefe and L. B. Wilson. *Light Metals,* v. 11, March 1948, p. 139-144.

Spot and seam-welding techniques; major difficulties hitherto associated with application of these to aluminum. A patented system, designed to eliminate the principal difficulties together with some experimental results obtained. It consists of interposition of steel strips between the electrodes and the sheets to be welded. This results in reduction of the welding current required, and consequent solution of the problems.

22d-18. The Pressure Welding of Aluminum Alloys. R. F. Tylecote. *Sheet Metal Industries,* v. 25, March 1948, p. 574-578.

General principles for pressure welding of sheet and bars and details of the experimental technique used in preparing pressure welds in the laboratory.

22d-19. Welding Aluminum. Section VI. *Reynolds Metals Technical Advisor,* v. 1, no. 6, p. 3-4.

Reprinted from "Welding Aluminum", Reynolds Metals Co., Louisville, Ky. (To be continued).

22d-20. Welding the Light Alloys. Part II. *Light Metals,* v. 11, March 1948, p. 120-127.

Procedures for aluminum and magnesium-alloy sheet and castings.

22d-21. Resistance Welding of Light Alloys. E. J. Keefe and L. B. Wilson. *Light Metals,* v. 11, March 1948, p. 139-144; see also "New Method of Welding Aluminum Alloys" (Same authors). *Welding,* v. 16, March 1948, p. 94-97.

Spot and seam welding techniques and certain major difficulties hitherto associated with application of these to aluminum. A patented system, designed to eliminate the principal difficulties, together with some experimental results obtained. It consists of interposition of steel strips between the electrodes and the sheets to be welded. This results in reduction of the welding current required, and consequent solution of the problems.

22d-22. Arc Welding of Aluminum and Its Alloys. (Continued.) A. Scharer. *Light Metals,* v. 11, March 1948, p. 161-170. Translated from Doctorate thesis based on work in the Research Laboratories of the Aluminium Industrie, A. G. Neuhausen, Switzerland, under A. von Zeerleder.

Summary of arc-welding techniques and consideration of specific problems involved in welding aluminum. Electrodes and fluxes for arc welding are examined. (To be continued.)

For additional annotations indexed in other sections, see:

2c-25; 15b-10-11-12; 21a-58; 24a-89; 24b-45-53; 27a-45.

(Turn to page 52)

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New Data Presented On Martempering, Martensite Formation

Reported by R. F. Thomson
International Nickel Co.

One of the finest talks ever presented before the Detroit Chapter A.S.M. rewarded an overflow crowd of over 600 members and guests on March 9, when R. H. Aborn, assistant director of the U. S. Steel Corp. Research Laboratory, described the formation of martensite and its adaptation in martempering. The talk was replete with new data, interesting correlations of existing data, and was knit together with unusual coherency.

Martensite formation is measureably dependent only on temperature; it is essentially timeless and occurs without nucleation, growth or diffusion. The temperature range over which it forms is lowered and widened by increasing carbon content. Triple alloy (Ni-Cr-Mo) steels usually have a lower martensite formation range of temperatures than a single or double alloy steel. In hypereutectoid steels such as 52100, increasing solution temperature, resulting in excess carbide solution, lowers the martensite formation temperature range. The actual composition of the austenite prior to transformation determines the martensite reaction. Proeutectoid rejection of ferrite results in carbon-enriched austenite, and rejection of carbide will result in carbon depletion.

Martensite provides the hardest matrix obtainable in steel, and when suitably tempered it offers highest shock toughness and resistance to crack propagation. However, the drastic cooling required to produce martensite generally leads to distortion, high residual stress and a tendency to crack. Martempering is a method for minimizing these latter tendencies without affecting the good properties.

Austenization conditions must be controlled for successful martempering. Minimizing oxidation of carbon and iron is very important because scale decreases cooling rate and lower carbon makes the steel more liable to transform above the Ms point. Cooling rate to the martempering temperature is important to get past the "nose" or "chin" of the S-curve. The cooling rate in salt at 450° F. is distinctly less than in oil at 125° F. A mixture of lead-bismuth has somewhat better cooling ability than salt when both are at 450° F.

Five minutes soak per inch of section is recommended when martempering in an industrial salt bath at 400° F. Air cooling from the martempering temperature will minimize any cracking tendencies. Dimensional changes can be controlled by adjustment of martempering temperature.

There is no significant difference in impact properties between martempered steels and those given the conventional quench and temper. Martempering limits the production of a given quenched structure or hardness in a given steel to a smaller section size than oil or water quenching.

The speaker warned that martempering is not a cure-all for poor design from the heat treating standpoint.

Sixth Biennial Interchapter Meeting To Be at Penn State

On June 11 and 12, 1948, the School of Mineral Industries of Pennsylvania State College will be host to the sixth biennial interchapter meeting of the American Society for Metals. The meetings were discontinued during the war. The Lehigh Valley, Northwest Pennsylvania, Penn State, Philadelphia, Pittsburgh, Southern Tier (New York), and York Chapters of the society will participate in the program. It is expected that some 3000 A.S.M. members will be represented at the meeting.

Three technical sessions beginning at 10 o'clock Friday morning, June 11, and continuing until noon Saturday, June 12, have been arranged through the cooperation of the participating chapters. At the Friday morning session, M. A. Grossmann, director of research for the Carnegie-Illinois Steel Corp. and past president of the national A.S.M., will present a paper on "Toughness and Fracture of Hardened Steels."

The Friday afternoon session will be made up of three papers dealing with the problem of notch sensitivity of steels, with particular emphasis on the structural grades commonly used in welded construction. Two papers will be presented at the Saturday morning session, one on mechanical testing by R. L. Templin, and one on principles of alloying by L. A. Carapella.

Requests for hotel reservations should be addressed to Dr. H. M. Davis, School of Mineral Industries, Pennsylvania State College, State College, Pa. Rooms in private homes within a few blocks of the campus will be available also if desired.

Those attending the meeting will be entertained at an informal dinner and smoker Friday evening at the Nittany Lion Inn. A ladies' program, including a tea Friday afternoon and visits to points of interest on the campus, is planned for the wives of members attending the meetings.

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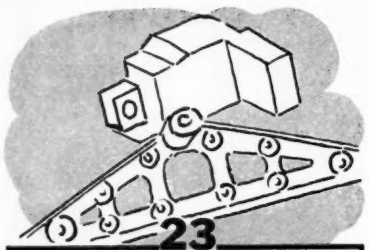

23 APPLICATIONS

23a—General

23a-20. Precision Castings in High-Melting Point Alloys for General Engineering Purposes. Frank Hudson. *Metallurgia,* v. 37, March 1948, p. 243-247.

Factors which have a bearing on economic production methods and possible new applications for such castings.

23a-21. Wire Forms. Part I. Herbert Chase. *Wire and Wire Products,* v. 23, April 1948, p. 303-305, 348-350.

Includes applications and production methods.

23a-22. They Pull Profits Up; Pull Expenses Down. *Modern Industry,* v. 15, April 15, 1948, p. 46-49.

Miscellaneous shapes and applications of magnets in production. One company alone has developed 24,000 uses.

23b—Ferrous

23b-21. Revolutionary Cessna Landing Gear Relies on Chromium-Vanadium Steel Springs. *Vancoram Review,* v. 5, no. 3, 1948, p. 3-5, 20.

Includes mechanical properties of steel used (S.A.E. 6150), and results of service tests.

23b-22. A Porcelain Enameling Application to a Private Home. *Better Enameling,* v. 19, March 1948, p. 11-13.

Concrete-block home with all exterior walls faced in acid-resisting, porcelain-enameled, steel-flanged panels. The panels are individually attached to the blocks at the time of erection by a specially designed patented clip.

23b-23. Research on "Thin Skin" Panels of Steel Being Pushed to Replace Masonry Walls. *Brick & Clay Record,* v. 112, March 1948, p. 38.

Development of wall system for curtain wall construction.

23b-24. Porcelain Enameled Garden Furniture After Eight Years of Outdoor Use. *Finish,* v. 5, April 1948, p. 27.

Photograph shows excellent durability.

23b-25. Latest Uses of Alloy Steels in Motor Vehicles. M. J. Day. *Automotive Industries,* v. 98, April 1, 1948, p. 26-27, 58.

Various types and their specific applications.

23b-26. Porcelain Enameled Murals Incorporated in Theater Restaurant Front. *Finish,* v. 5, April 1948, p. 28, 42.

23c—Nonferrous

23c-26. Finding and Fighting Marine Borers. Part III—Metal Armor and Concrete Jacketing. Robert D. Chellis. *Engineering News-Record,* v. 140, April 1, 1948, p. 73-76.

Methods for protecting timber.

23c-27. Modern Uses of Hard Metal. H. Burden. *Alloy Metals Review,* v. 5, March 1948, p. 2-11.

An effort is made to classify the various grades according to composition and properties, and to show how they can be applied with advantage.

23c-28. Uses of the Rarer Metals. *Canadian Metals & Metallurgical Industries,* v. 11, March 1948, p. 13.

Some new developments.

23c-29. Performance of Cemented Carbides. *Machinery* (London), v. 72, March 25, 1948, p. 401.

Some interesting performance examples quoted by G. J. Trapp in a paper read recently before the Manchester Association of Engineers.

23c-30. Novel Uses for Tungsten Carbide. H. Sanders. *Machinery Lloyd* (Overseas Edition), v. 20, March 27, 1948, p. 75-77.

Some more recent and novel applications. These include use for rolls, for dies, for burnishing balls, for files, for valves and seats, for tools, for milling cutters, and other applications.

23c-31. Die Castings in the G. E. Magnetic Tracer Control. T. R. Tappan. *Die Castings,* v. 6, April 1948, p. 33-34, 54-55.

Simplified assembly of new magnetic tracing head by use of magnetic laminations as inserts in Zn and Al die castings.

23d—Light Metals

23d-50. Les Métaux de Remplacement du Cuivre dans la Construction des Lignes de Contact Pour Tramways et Trolleybus. (Replacement Metals for Copper in Construction of Contact Cables for Street Cars and Trolley Buses.) Louis Albert. *Revue de l'Aluminium,* v. 25, Jan. 1948, p. 3-12.

Results of tests of substitutes for Cu in trolley wires. Almelec (Fe, up to 0.35%; Si, 0.6 ± 0.1%; Mg, 0.7 ± 0.1%; and Fe, balance); steel combinations; and other alloys were used. Wear test data are given and it is indicated that such replacement is possible and is economically sound.

23d-51. L'Aluminium aux de l'Emballage et de l'Emouteillage. (Aluminum at the Packing and Bottling Show.) Pierre Prevot. *Revue de l'Aluminium,* v. 25, Jan. 1948, p. 21-32.

Numerous applications as shown at the exhibition.

23d-52. Aluminum Cans a Clean Bill! *Light Metals,* v. 11, March 1948, p. 115-119.

A few months ago the British Ministry of food issued a circular which stated: "Applications [for import licenses] for goods packed in other than tinplate will not be supported". This is a particularly severe blow to the Norwegian canning industry which uses aluminum cans extensively. Presents data and arguments to prove that, as a container material for food products, aluminum is just as good as tinplate, and in some cases, even to be preferred.

23d-53. Aluminum Foil. Part II. Structure of Foil Packages. Quantitative Data on the Efficiency of Various Types of Closures in Excluding Moisture; Mechanical Strength of Heat-Sealed Joints; Moisture-Excluding Efficiencies of Bags and Cartons; Cooling Rates of Cartons With and Without Boil Liners. Junius D. Edwards and D. B. Strohm. *Modern Packaging,* v. 21, March 1948, p. 150-153, 188-189.

23d-54. What About Magnesium Plates? Recent Tests Seem to Add Up Their Good Points. Sam A. Cousley. *Printing Magazine,* v. 72, March 1948, p. 48-49.

23d-55. The Base is Basic Uni-Base. W. G. Clingman, Jr. *Photo-Engravers Bulletin,* v. 37, March 1948, p. 13-18.

"Uni-Base" is magnesium used in place of wood as a mounting material in engraving, electrotyping, and printing. Its properties, processing, and advantages.

23d-56. Light Alloy Developments at Kaiser-Frazer. Clay P. Bedford. *Modern Metals,* v. 4, March 1948, p. 17-19.

Some of the uses presently being developed, including die-cast Al doors, sheet-Al gas tanks, die-cast Mg wheels, and several other applications still in the early stages.

23d-57. Magnesium Castings for the Allison Turbo-Jet Engine. J. Walraven. *Modern Metals,* v. 4, March 1948, p. 20-22.

Mg-casting applications for the engine which is being used in the P-80 Shooting Star. General magnesium foundry practice, heat-treating procedure, and several new developments.

23d-58. New Automatic Washer. *Modern Metals,* v. 4, March 1948, p. 24-25.

"Coronado" washer utilizes aluminum throughout.

23d-59. Magnesium in Germany During World War II. Part III. Hubert Altwicker. *Modern Metals,* v. 4, March 1948, p. 26-30.

Use of magnesium for grenades, mines, flame throwers, machine-gun parts, field hospitals, paratroop equipment, welding practice, and woven and spun wire goods.

23d-60. German Automobile Firm Utilizes Magnesium. *Modern Metals,* v. 4, March 1948, p. 30.

Experience of Opel Co., Russelsheim.

23d-61. Cast Electrical Hardware for High Tension Lines. *Modern Metals,* v. 4, March 1948, p. 36.

Use of aluminum hardware.

23d-62. Magnesium Industrial Doors. J. Mezoff. *Modern Metals,* v. 4, March 1948, p. 38.

Advantages.

23d-63. Eighty-Pound Piano. *Modern Metals,* v. 4, March 1948, p. 40.

Lightweight piano utilizes magnesium and plastics.

23d-64. Aluminum in Freight-Car Construction. R. B. Boruck and E. A. Sipp. *Railway Age,* v. 124, March 27, 1948, p. 38-41; also *Railway Mechanical Engineer,* v. 122, April 1948, p. 72-75. A condensation.

How much aluminum is used? What weight saving is attained? These questions are discussed in relation to 50-ton box and 50-and 70-ton hopper cars. (Presented at annual meeting, A.S.M.E., Atlantic City, Dec. 4, 1947.)

23d-65. Aluminum and Its Alloys. *Metallurgia,* v. 37, Feb. 1948, p. 185-186, 194.

New alloys, fabrication processes and applications.

23d-66. Light Alloy Piston Materials. A. Schofield and L. M. Wyatt. *Metallurgia,* v. 37, Feb. 1948, p. 187-194.

Compositions, properties, and structures of typical commercial piston alloys. Temperature distributions in different types of pistons in connection with design and with selection of alloys. Compositions of commercial alloys and attempt to show relationships among basically similar British, U. S., and German alloys.

23d-67. Light Alloys in the Internal-Combustion Engine. (Continued.) *Light Metals,* v. 11, March 1948, p. 145-152.

Light-alloy bearings and the possible application of light alloys to crankshafts and camshafts. Use of powdered metals. (To be concluded.)

23d-68. Will We Follow Europe in the Use of Aluminum Cans? John V. Ziemba. *Food Industries,* v. 20, April 1948, p. 94-95, 228, 230.

(Turn to page 54)

Two New Steels Designed for Hobbing And Plastic Molds

Reported by Knox A. Powell
Research Engineer, Minneapolis-Moline Power Implement Co.

"Plastic Mold Steels" was the subject presented by Maurice C. Fetzer, director of the research laboratory at the Carpenter Steel Co. (and a graduate of our own University of Minnesota School of Mines), at the March 18th meeting of the North West Chapter A.S.M. The talk was illustrated with slides showing mold sections, mold sinking methods, mold faults, and plastic mold products.

Mold steels have generally been limited in the past, said Mr. Fetzer, to standard alloy compositions with low carbon (such as S.A.E. 3310) or to pure iron. The latter can be softened for a maximum depth of cold hobbing or hubbing but cannot be made tough enough to support a case-hardened surface under high molding pressures. The standard alloy steels, even with low carbon, are less readily cold hobbed, and some will only take very shallow impressions unless the cavity is first machined out close to size.

Two new mold steels especially designed for hobbing are being introduced by Carpenter Steel. One steel with 0.1% carbon and 2.5% chromium can be hobbed almost as well as pure iron but will develop higher core strength and toughness in heat treatment after casehardening. The second mold steel contains 5% chromium, 1.00% molybdenum, and 0.25% vanadium, and can be annealed for hobbing and oil or air hardened after carburizing.

Mr. Fetzer noted the use of stainless steels such as 13% chromium, 0.35% manganese, and 0.35% silicon for molding chemically active materials, although, of course, these steels do not remain stainless if carburized for added surface hardness and do not hob readily. Nondeforming steels —for example, 1.5% manganese and 0.9% carbon—although difficult to hob, are used when dimension changes in heat treatment must be minimized.

Methods of reducing metal flow in hobbing without introducing shear failures were pointed out. A mold retention ring may be elevated above the hobbing press platen to accommodate flash without adverse flow of the metal. Cavities may be cut under the impressions to receive extruded metal, but must be so shaped as to support shear areas against punch action. High polish on the hobbing surfaces, and metallic lubricant of the hob with copper plate (sometimes also with mercury amalgam), ease the metal flow.

Foley Gets Canadian Gift

The Iron and Steel Industry Was Traced From Its Beginnings Some 4000 Years Ago to the Present Day by Francis B. Foley, National President A. S. M., at a Meeting of the Ottawa Valley Chapter on April 6. Mr. Foley is shown holding a steel machete presented to him with the compliments of Burgess Tools Co. as a memento of the occasion. Left to right are N. B. Brown, secretary-treasurer of the Chapter; Molson Hannaford, chairman; Mr. Foley; H. H. Bleakney, technical chairman; and G. T. Burgess, vice-chairman. (Reported by A. R. Deir)

INTERESTED IN HEAT TREATING?

Then you will want to see the July issue of Metals Review. Big feature article will be a review of all magazine articles and books on heat treatment that have appeared during the first half of 1948.

Written by a staff member of Battelle Memorial Institute, this important article will emphasize the important developments of the past six months for your convenient use and reference.

Be sure to look for the July Heat Treating Issue.

Note to Manufacturers of Heat Treating Equipment

If you have a new product, or one that has been improved or re-designed, during the past six months, send us a brief description and glossy photograph. We will give your material every consideration for inclusion in the product review article that will be the second editorial feature in this important issue.

Just mail your material to reach us prior to June 10.

METALS REVIEW

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Technical and economic factors involved. Although Norway is using aluminum cans in quantity, their adoption in the U. S. is being held back by cost differentials and other factors.

23d-69. Full Measure Obtained. *Die Castings,* v. 6, April 1948, p. 25-26, 57.
Use of die-cast Al housing and valve plate for gas meters.

23d-70. For the Record. *Die Castings,* v. 6, April 1948, p. 27-29, 45-48.
Use of more than 50 die-cast Al parts in the Recordak Microfilmer. Savings in machining made possible by die casting.

23d-71. Efficient Operation. *Die Castings,* v. 6, April 1948, p. 30, 55.
Savings made possible by redesign of two small parts for Al-alloy die casting.

23d-72. Die Castings—Structural Members in Automobiles? *Die Castings,* v. 6, April 1948, p. 39-40.
Development work on light-metal die castings for auto wheels, doors, and instrument panels. (Based on address by Clay Bedford before Cleveland Chapter, A.S.T.E., Feb. 13, 1948,)

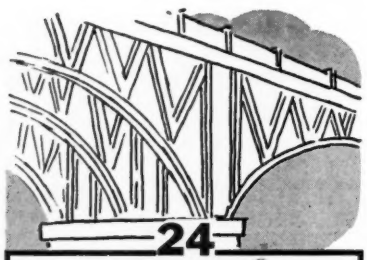
23d-73. Magnesium Die Castings; A Progress Report. *Die Castings,* v. 6, April 1948, p. 42-45.
Products now being constructed of magnesium die castings. Outlines factors to be considered in deciding whether or not to use Mg die castings for a specific job.

23d-74. Some Cost Comparisons. Karl F. Theobold. *Die Castings,* v. 6, April 1948, p. 41, 56-57.
Comparative costs for two parts used in aviation ground trainers manufactured for the Army and Navy, using Zn die castings or machining.

23d-75. Where Aluminum Replaces Steel in Ford and Mercury Cars. *Automotive Industries,* v. 98, April 15, 1948, p. 42-43, 67.

For additional annotations indexed in other sections, see:

2c-23; 3b-52; 3c-17; 3d-20; 6b-27; 14c-27; 24a-86; 24c-24; 27b-18; 27c-8.



24 DESIGN and STRESS ANALYSIS

24a—General

24a-80. The Statistical Estimation of the Effect of Size on the Breaking Stress of Rods. C. Gurney. *Aeronautical Research Council, Reports and Memoranda* No. 2157, (Great Britain), March 1945, 10 pages.
Methods for estimating the size effect from the scatter of test results. Thousands of test results are necessary to obtain a reasonable estimate of the strength of material whose size differs much from that tested. The theory strictly applies only to material which is statistically homogeneous. However, many practically useful materials do not meet this condition; for such materials the theory gives only qualitative results, the predicted strength to size gradient being usually greater than that obtained experimentally.

24a-81. On the Cantilever Composed of a Number of Parallel Beams Interconnected by Cross Bars. Letitia Chitty. *Philosophical Magazine,* 7th Series, v. 38, Oct. 1947, p. 685-699.
A mathematical analysis of the above structural problem.

24a-82. An Integral-Equation Approach to Problems of Vibrating Beams. Walter T. White. *Journal of the Franklin Institute,* v. 245, Jan. 1948, p. 25-36.
Integral equations are applied for the calculation of the normal modes of vibrating beams. Both exact and approximate methods of solving the integral equation are considered. The Green's function, or kernel, of the integral equation is constructed for both uniform and nonuniform beams. Solutions for the normal modes of a uniform cantilever. A nonuniform, naturally-twisted turbine blade is studied in detail and the first and second normal modes are calculated.

24a-83. Needle Bearings in Tapping and Threading Unit. *Bearing Engineer,* v. 8, Jan.-Feb. 1948, p. 2-3.
Cutaway drawings show design details.

24a-84. The Plastic Flow of Thick-Walled Tubes With Large Strains. C. W. MacGregor, L. F. Coffin, Jr., and J. C. Fisher. *Journal of Applied Physics,* v. 19, March 1948, p. 291-297.
Theory for a material having an arbitrary true stress-strain curve, loaded by any combination of internal pressure, external pressure, and end load. Comparisons are made of the finite-strain theory, the infinitesimal strain theory, and experimental results for the special case of a closed-end thick walled aluminum tube. The infinitesimal-strain theory was found to be considerably in error even at moderate strain values. The finite-strain theory appears to be satisfactory even for strains somewhat beyond the value for the local bulging of thick-walled tubes.

24a-85. Effects of Cutouts in Semi-monocoque Structures. P. Cicala. *Journal of the Aeronautical Sciences,* v. 15, March 1948, p. 171-179.
Stress distribution in monccoque structures having cutouts has previously been investigated by several authors under the assmuption of rigid frames. This problem is dealt with for the circular cylinder reinforced by equal and equally spaced stringers and by equal flexible circular frames.

24a-86. Manufacture of Mill Type Motors. C. B. Hathaway. *Iron and Steel Engineer,* v. 25, March 1948, p. 105-106.
Design of improved type and miscellaneous fabrication procedures at Westinghouse Electric Corp., Buffalo.

24a-87. Stresses in and General Instability of Monocoque Cylinders With Cutouts. VI — Calculation of the Buckling Load of Cylinders With Side Cutout Subjected to Pure Bending. N. J. Hoff, Bertram Klein, and Bruno A. Boley. *National Advisory Committee for Aeronautics, Technical Note No.* 1436, March 1948, 30 pages.
A strain-energy theory was developed for calculation of the above. The theory was applied to two series of specimens, each containing three cylinders. Average deviation between theoretical and experimental buckling load was 27.1% for the first series and 34.4% for the second.

24a-88. Photo-Elastic Investigation of Internal Stresses in Silver Chloride Caused by Plastic Deformation. J. F. Nye. *Nature,* v. 161, March 6, 1948, p. 367-368.
Since X-ray diffraction investigation of stresses in cold worked metals can indicate only the presence and magnitude of internal stresses, but not their spatial distribution, transparent crystals of AgCl were investigated under conditions of plastic deformation. It is believed that the results, which are illustrated, are also applicable to metals.

24a-89. Designing for Resistance Welding. Ernie Lauter. *Industry and Welding,* v. 21, April 1948, p. 82-84.
Examples include combination aluminum storm and screen windows and garden tools.

24a-90. Effect of Embedding the Ends of Rods in Elastic Material on Their Bending Strength. (In Russian.) A. N. Dinnik and Z. B. Pinskaya. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Dec. 1947, p. 1585-1588.
A mathematical solution for the above problem for the case in which both ends are embedded in an elastic or plastic material, the strengths of the two end fastenings being unequal and load being applied at the middle of the rod.

24a-91. Another "Twist" to Torsion Springs. *Mainspring,* v. 12, April 1948, p. 2-7.
Design formulas and tables and applications.

24a-92. Salient Features of Handwheel Design. H. F. Williams. *Machine and Tool Blue Book,* v. 44, April 1948, p. 205-206, 208, 210, 212, 214, 216-218, 220.
Third of series on machine-tool handwheels covers counterbalancing at the rim; modernistic designs; unbalanced handwheels; position of operating handle; and large light handwheels. (To be concluded.)

24a-93. Systematic Expression for Stress-Strain-Temperature Relationships. Michael B. Corson. *Metal Progress,* v. 53, April 1948, p. 538.
Questions use of the formula: $\delta\varepsilon = Ke^{q/rt}$ to connect the stress corresponding to the strain to the absolute temperature T at which the testing is done, and presents what is believed to be a more logical approach to the problem.

24a-94. A General Approximation Method in the Theory of Plates of Small Deflection. M. Zbigniew Krzywoblocki. *Quarterly of Applied Mathematics,* v. 6, April 1948, p. 31-52.
A new method which aims at solution of the problem quite independently of the shape of the plate. If there is no lateral load, that is, if the forces act in the plane of the plate, the method is successful whether the forces are distributed uniformly or not. If there is a lateral load, the method is not always successful. 10 ref.

24a-95. Industrial Safety and the Tool Designer, H L. Smith. *Tool Engineer,* v. 20, April 1948, p. 25-28.
Items which illustrate principles of tool design for safety.

24a-96. Precision Investment Casting. Edwin Laird Cady. *Product Engineering,* v. 19, April 1948, p. 81-85.
Characteristics of alloys used, effect of machinability on design, and detailed design procedure for high and low-machinability alloys.

24a-97. How to Organize for Experimental Stress Analysis. *Product Engineering,* v. 19, April 1948, p. 113-136.
Various equipment requirements,
(Turn to page 56)

Specifications for Cast Iron Often Confusing—Ludwig

Reported by G. W. Birdsall
Manager, Technical Editorial Service
Reynolds Metals Co.

Cast iron foundries are frequently called on to furnish castings to meet chemical specifications which in many cases are unnecessary, inadequate and confusing and which, while placing an unnecessary burden on the foundry, will not insure that the purchaser will receive castings satisfactory for his requirements, John N. Ludwig, Jr., division manager, technical service and development department of Electro Metallurgical Co., Pittsburgh, stated in his talk on March 12 before the Louisville Chapter. Addressing one of the largest meetings of the current season, he spoke on "Control and Foundry Methods in Modern Production of Plain and Alloy Cast Irons".

The factors which determine the suitability of a gray iron casting for any given application are its physical properties as determined by the properties of the iron matrix and the amount, type and distribution of the free graphite. All well-managed, modern foundries know how to regulate the structure of their cast iron for sections of various thicknesses so that if the purchaser utilizes the knowledge available today as to how the size, type, amount and distribution of the graphite and the matrix characteristics influence the machinabilty, hardness, strength, heat and corrosion resistance, and damping capacity of cast iron, he can specify the structure and properties for his particular applications. In this way he will be getting "the most for his casting money" when buying gray iron castings.

Ferro-alloys and ferro-alloy briquets in cupola charges, and the use of ladle inoculants of so-called "graphitizer" or "carbide stabilizer" types, or additions of other alloying types of metals such as chromium, nickel, copper, and molybdenum, are indispensable to achieve the aforementioned type of control, Mr. Ludwig stated.

His talk described the various commercial ferro-alloys and inoculants available, and he dwelt at some length on the practical uses of these materials—their benefits as well as limitations. Data presented illustrated conditions for optimum benefits from the use of ladle inoculants.

The use of chromium as an alloying agent in iron was discussed at some length. Small fractional percentages of this element reduce growth in ordinary gray iron; with 2% chromium this growth is practically eliminated, even after a large number of cyclic heatings at temperatures as high as 1450° F. Simultaneous effective ladle additions of a proper graphitizer (to produce about 3% total silicon in the iron) keep these 2% chromium irons machinable while maintaining their freedom from tendency to grow.

For oxidation (scaling) resistance, and high-temperature abrasion resistant irons, higher chromium contents—14% to as high as 34%—are specified and used with considerable success, according to the speaker.

Stainless Production Filmed

Use of oxygen and other modern techniques for electric furnace production of stainless steel is brought to the screen in full color in the latest motion picture to be released by Allegheny Ludlum Steel Corp. Titled "Melting and Refining of Modern Steels," the 16-mm., 20-min. movie was shot at the company's Brackenridge, Pa., plant and is a start-to-finish story of stainless steel as it is melted in a modern 50-ton electric furnace. Telephoto lenses are used for interior shots, and the process of injecting oxygen directly into the molten metal for carbon reduction is portrayed. The film may be obtained for free showings on request to the company's headquarters in Pittsburgh.

Palmer Elected President Of Carpenter Steel Co.

Frank R. Palmer, former vice-president in charge of sales, has been elected president of Carpenter Steel Co. to succeed J. Heber Parker.

F. R. Palmer

The new president is a graduate of the University of Pennsylvania in chemical engineering. He came to Reading 31 years ago as foreman of Carpenter's electric furnace melting department. From 1918 to 1928 he served as a member of the metallurgical department, and was then appointed assistant to the president, handling advertising and sales development. He was elected vice-president in charge of sales and a member of the board in February 1941. Mr. Palmer is the author of the well-known textbook "Tool Steel Simplified".

Carpenter Steel Co. has also announced the promotion of Omar V. Greene from assistant general sales manager to manager of product development. Mr. Green joined the Carpenter Steel Co. in 1928 as a staff metallurgist. He became manager of tool and alloy steel sales in 1940.

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advantages, limitations, costs, and specific information on techniques utilizing brittle coatings, photo-elasticity, electric strain gages, and mechanical strain gages.

24a-98. Formulas for Spring Redesign. A. Bodenshatz. *Product Engineering*, v. 19, April 1948, p. 143.

Equations to solve problems of reducing spring stress without changing spring rate, installed height or solid height of circuit-breaker springs.

24a-99. Strain Gage Technique Employed in Studying Propane Tank Stresses Under Service Conditions. L. P. Zick and C. E. Carlson. *Steel*, v. 122, April 12, 1948, p. 86-88.

Method used to study stresses in long horizontal storage tanks supported in two places. 116 delta-type, Baldwin SR-4 strain gages were mounted and connected to control equipment for determining effect of variations in position of supporting saddles on stresses in shell and head of a 30,000 gal. tank.

24a-100. Lighter and Stronger Car Bodies Using Aircraft Design Practices. E. W. Conlon and G. W. Lothrop. *Automotive Industries*, v. 98, April 15, 1948, p. 46-48, 68, 70. A condensation.

Research at University of Michigan shows that strength and rigidity requirements of the conventional passenger car, as determined by static tests and stress analysis for bending and torsion, can be met by lighter body and frame structure, when built in accordance with aircraft-design principles. (Presented at recent convention, American Society of Body Engineers, Detroit.)

24b—Ferrous

24b-43. The Effect of Length on the Strength of a Steel Wire. C. Gurney and S. Pearson. *Aeronautical Research Council, Reports and Memoranda No.* 2158, (Great Britain), Nov. 1945, 13 pages.

Sets of strength tests on two lengths cut from the same coil of steel wire were made, each set consisting of about 100 tests on nominally indentical test pieces. Results were compared with those predicted by statistical theory assuming that a normal distribution of strength would be obtained for a unique, but initially unknown, length of wire, and that the strength of the wire is statistically homogeneous. The experiments show small, but significantly different distributions of strength of the long and short wires, the general trends of the results being in agreement with theory.

24b-44. What Can Be Recommended to Overcome the Cracking of Boiler Shells at the Riveted Seams and Other Places, Which Develop in Our Present Day Steam Locomotive Boilers. *Master Boiler Makers' Association, Official Proceedings of the 1947 Annual Meeting*, 1947, p. 235-249; discussion, p. 249-258.

A committee report. Photographs and photomicrographs show various service failures which were thoroughly studied to determine causes and remedies. Makes recommendations for design changes to minimize these failures, and also for future work.

24b-45. A New Type of Firebox Construction. Howard L. Miller. *Master Boiler Makers' Association, Official Proceedings of the 1947 Annual Meeting*, 1947, p. 267-278; discussion, p. 278-282.

New design utilizing a Cr-stainless steel known as Enduro AA or A.I.S.I. 430 in welded construction. Comparative Charpy impact values for this steel and for the steel usually used.

24b-46. The Effect of Nonuniform Distribution of Stress on the Yield Strength of Steel. Dimitry Morkovin and Omar Sidebottom. *Engineering Experiment Station, University of Illinois*, Bulletin Series No. 372 (v. 45, no. 26), Dec. 18, 1947, 74 pages.

Experimental results show that, except to a small degree in one specimen, the stress required to start yielding in the presence of a stress gradient was not higher than was required in a uniform stress field. Part I deals mainly with the beginning of yielding in members with nonuniform stress distribution when the material does not exhibit an upper yield point. Part II considers the effect exerted on the beginning of yielding by an upper yield point in addition to a stress gradient.

24b-47. The Behavior of Stanchions Bent in Double Curvature. J. F. Baker and J. W. Roderick. *Welding Research*, v. 2, Feb. 1948, p. 2r-24r. (Bound with *Transactions of the Institute of Welding*, v. 11.)

5th Interim Report of FE. 1 Committee on Load-Carrying Capacity of Frame Structures of the British Welding Research Assoc. is illustrated with photographs and diagrams showing the test equipment.

24b-48. Balanced Forces in High Pressure Pumps. Ralph G. Paul. *Western Machinery and Steel World*, v. 39, March 1948, p. 86-89, 115, 126.

Design and fabrication of new type of centrifugal pump used for generating hydraulic power. Produced by Byron Jackson Co., Los Angeles.

24b-49. Large Plastic Flow and the Collapse of Hollow Cylinders. P. W. Bridgman. *Journal of Applied Physics*, v. 19, March 1948, p. 302-305.

The collapse of heavy steel cylinders under external pressures running up to 412,000 psi. was studied during the war under contract with Watertown Arsenal. The distortions are so large that conventional small-strain analysis is not adequate. The presence of large strains is recognized in the analysis by writing the stress equations of equilibrium in terms of the final displaced positions of the particles instead of in terms of the initial positions. Results indicate that strain hardening increases continually with increasing distortion, but at a rate two or threefold less than would be given by experiments in simple tension.

24b-50. Hoisting Rope Research in Ontario Mines. R. E. Dye, R. D. Parker, and R. L. Healy. *Canadian Mining and Metallurgical Bulletin*, v. 41, March 1948, p. 158-171.

Research program and progress to date. Study of the occurrence and causes of the various forms of rope and wire deterioration with particular emphasis on causes and prevention of corrosion; development of improved lubricants and methods of application; microscopic and metallographic studies of the steel in the wire; detection of the presence of corrosion and other deteriorating influences by nondestructive methods; results of tensile tests made on discarded hoisting ropes; and a study of mechanical features of hoisting installations. (To be presented at annual meeting, Canadian Institute of Mining and Metallurgy, Vancouver, B. C., April 1948.)

24b-51. Latest Lubrication Developments Applied to World's Fastest Cold Strip Mill. *Steel*, v. 122, March 29, 1948, p. 86, 89.

Recently installed 36-in., continuous, five-stand, tandem, cold reduction mill at the Aliquippa plant of Jones & Laughlin Steel Corp., which utilizes four separate lubrication systems.

24b-52. Ferromagnetic Metals; Identification and Measurement of Internal Stresses. Part I — Magnetic Tests. (Continued.) Albert Borowik. *Iron and Steel*, v. 21, March 1948, p. 81-86.

Sources and magnitude of errors in magnetic measurements. Existing methods for calculation of stresses from results of magnetic measurements. Magnetic data previously presented in this series are plotted on three-dimensional diagrams. These show variation of coercive force and energy loss due to hysteresis with degree of cold work; stresses produced by external loads in wires of various carbon contents which had been cold-worked and stress relieved; and variation in maximum induction, remaining induction, and maximum magnetic permeability with degree of cold work and stress. Conclusions resulting from study of the diagrams. (To be continued.)

24b-53. Tubular Air Heaters of Welded Construction. A. N. Clark, James Longhray, and W. Denovan Garrick. *Engineer*, v. 185, March 19, 1948, p. 289-292; March 26, 1948, p. 313-315.

Four medium-sized, tubular, air heaters designed and fabricated for a large water-tube boiler installation. Structural details are clarified by numerous photographs and diagrams. Cost data are also discussed and charted.

24b-54. Die Casting Die Design. Part I. (Continued): Square and Rectangular Ejector Pins; Methods of Ejection Other Than by Ejector Pins; Air Ejection; Dimensioning the Pin. *Tool & Die Journal*, v. 14, April 1948, p. 56, 58-60, 62, 84.

Design of these features. (To be continued.)

24b-55. Design and Construction of Staybolted Fireboxes. F. P. Huston. *Railway Mechanical Engineer*, v. 122, April 1948, p. 65-69, 80. A condensation.

Minor changes in design and use of new alloys are suggested as means to improve locomotive firebox performance. (Presented at meeting of Railroad and Metals Engineering Divisions, A.S.M.E., Atlantic City, Dec. 2, 1947.)

24b-56. Internally Insulated Pressure Vessels, Piping, for High Temperature Service. P. E. Darling. *Petroleum Processing*, v. 3, April 1948, p. 339-340, 342, 344.

Application of internal insulation has made possible satisfactory and economical construction of vessels and piping for a number of processes where the requirements of large lines and vessels for high-temperature service make the use of suitable alloy steels uneconomic. Results obtained with various alloy, ceramic, and plastic combinations.

24b-57. Dimensional Instability Affects Design of Precision Equipment. Parts III and IV. Frederick C. Victory. *American Machinist*, v. 92, March 25, 1948, p. 112-115; April 8, 1948, p. 112-115.

Suggestions for steels possessing good stability after customary heat treatment, and a simple test for use after tempering. Residual and applied stresses play very important parts in stability and functioning of machine elements.

(Turn to page 58)

IMPORTANT MEETINGS
for June

June 6-11—Society of Automotive Engineers. Summer Meeting, French Lick Springs Hotel, French Lick, Ind. (John A. C. Warner, secretary, S.A.E., 29 West 39th St., New York 18.)

June 7-11—Pittsburgh International Conference on Surface Reactions, Mellon Institute for Industrial Research, Pittsburgh. (Richard Rimbach, secretary, 1117 Wolfendale St., Pittsburgh 12.)

June 10-12—Armour Research Foundation of Illinois Institute of Technology. Symposium on Electron and Light Microscopy, Stevens Hotel, Chicago. (W. C. McCrone or C. F. Tufts, Armour Research Foundation, Illinois Institute of Technology, 35 West 33rd St., Chicago 16.)

June 11-12—Sixth Biennial Pennsylvania Interchapter Meeting American Society for Metals, School of Mineral Industries, Pennsylvania State College. (H. M. Davis, School of Mineral Industries, State College, Pa.)

June 16-18.—Electric Metal Makers Guild. 16th Annual Meeting, Bethlehem, Pa. (D. L. Clark, secretary, Box 6026 Mt. Washington Station, Pittsburgh 11.)

June 21-25—American Society for Testing Materials. 1948 Annual Meeting, Book-Cadillac Hotel, Detroit. (C. L. Warwick, executive secretary, A. S. T. M., 1916 Race St., Philadelphia 3.)

June 28-July 1—American Electroplaters' Society. Annual Convention and Industrial Finishing Exposition, Ambassador Hotel and Convention Hall, Atlantic City, N. J. (A. E. S., 473 York Rd., Jenkintown, Pa.)

Zirconium and Cerium Used in New Alloys of Mg

Reported by Howard J. Godfrey
Assistant Chief Development Engineer John Roebling's Sons Co.

The rapid growth of the magnesium industry from small-scale production methods to the large reverberatory furnaces that are now in use, was emphasized in a talk reviewing the history of the industry and describing the new magnesium alloys. J. C. McDonald of Dow Chemical Co., speaking before the Philadelphia Chapter A.S.M. on Feb. 27, pointed out that on an equal weight basis a more simplified design can often be obtained than by using a heavier metal.

Magnesium alloys have excellent deep drawing characteristics when heated, and large, intricate forgings can be manufactured. An 18,000-ton press is now in operation in the United States for forging magnesium alloys. Dr. McDonald also illustrated the adaptability of magnesium alloys for castings, and emphasized that the supply of the metal is unlimited.

Reference was made to the early development of magnesium alloys by Germany. In discussing physical characteristics the speaker stated that resilience of magnesium alloys, when compared on an equal weight basis, is considerably greater than that of other materials. Metallurgical aspects of the magnesium alloys have been studied with both the light microscope and electron microscope, the latter being of great advantage in studying changes in structures.

The addition of zirconium to magnesium-zinc alloys raises the solidus temperature, making it possible to work the alloys at higher temperatures without hot shortness. Zirconium also imparts a fine grain with resultant better physical properties of the alloy.

A recent development is the use of the rare earths, particularly cerium, as alloying elements. A 6% addition of cerium improved the creep properties. One of the newer applications of magnesium alloys is for photo-engraving and for direct printing of newspapers.

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24c—Nonferrous

24c-7. Conductor Vibration Studies on Energized 230-Kv. Lines. M. G. Poland and M. B. Elton. *Electric Light and Power,* v. 26, March 1948, p. 48-53.

Recording instruments used by the Bonneville Power Administration in the field measurement of conductor vibration; recent experience with fatigue damage. (Presented at General Meeting, A.I.E.E., Aug. 1947.)

24c-8. Flexible Tubing With a High Strength "Double Hook". *Inco,* v. 22, Spring 1948, p. 18.

Production of flexible monel tubing having unique high-strength design capable of withstanding pressures up to 7000 psi.

24c-9. Proposal: Die Cast Sprayer Nozzles. L. Wayne Lauver. *Die Castings,* v. 6, April 1948, p. 37-38.

Present and proposed designs. Advantages of latter.

24d—Light Metals

24d-12. Dependence of the Stress-Strain Curves of Cold-Worked Metals Upon the Testing Direction. J. J. Klingler and G. Sachs. *Journal of the Aeronautical Sciences,* v. 15, March 1948, p. 151-154.

Yield strength and stress-strain curve of cold worked aluminum-alloy plate were found to depend considerably upon the angle between the directions of the largest principal strains in cold working and testing, respectively. This directionality develops as a result of a small amount of cold work and then remains approximately constant, and is closely related to the Bauschinger effect.

24d-13. Stress and Distortion Measurements in a 45° Swept Box Beam Subjected to Bending and to Torsion. George Zender and Charles Libove. *National Advisory Committee for Aeronautics, Technical Note* No. 1525, March 1948, 36 pages.

Tip-bending and twisting loads were applied to an Al-alloy box beam with 45° sweep and stresses and distortions were measured. The bending tests revealed a considerable build-up of normal stress and vertical shear in the rear spar near the fuselage for the sweptback box beam. No such marked effect accompanied torsion.

24d-14. Compressive Strength of 24 S-T Aluminum-Alloy Flat Panels With Longitudinal Formed Hat-Section Stiffeners Having Four Ratios of Stiffener Thickness to Skin Thickness. William A. Hickman and Norris F. Dow. *National Advisory Committee for Aeronautics, Technical Note* No. 1553, March 1948, 41 pages.

Results for panels in which the thicknesses of the stiffener material are 0.39, 0.63, 1.00, and 1.25 times the skin thickness.

24d-15. Light Alloy Body-Building Progress. *Light Metals,* v. 11, March 1948, p. 135-137.

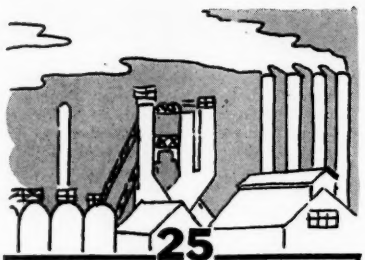
Design and construction of Al-alloy truck bodies by British concern.

24d-16. Aluminum Piping; How to Use. C. B. McLaughlin. *Heating, Piping & Air Conditioning,* v. 20, April 1948, p. 78-82.

Lack of detailed specifications in the various codes; recommended allowable working pressures for process piping are given except where specifically covered in codes.

For additional annotations indexed in other sections, see:

8-66-67; 12b-20; 19a-77; 20a-151: 22b-118; 27b-26.



25 STATISTICS

25a—General

25a-33. Acute Metal Shortage Pends. *Steel,* v. 122, April 12, 1948, p. 56-57, 142.

Statistics.

25b—Ferrous

25b-44. Statistics of the Iron and Steel Industry of the United Kingdom (For the Years 1939-1944). British Iron and Steel Federation, Sept. 1945, 57 pages.

25b-45. Economics of Britain's Steel Industry, Robert Shone. *Iron and Steel Engineer,* v. 25, March 1948, p. 66-68.

A report prepared for a broadcast on the BBC.

25b-46. The Gray Iron Castings Industry. (Concluded.) Raymond L. Collier. *Foundry,* v. 76, April 1948, p. 90-91, 138, 141, 145, 148, 150.

Part of a report recently prepared by Gray Iron Founders' Society.

25b-47. Adequacy of Our Steel Capacity for Peace or War. Robert E. Johnson. *Military Engineer,* v. 40, April 1948, p. 158-160.

25b-48. Industry's Steel Needs. *World Oil,* v. 127, April 1948, p. 57-58, 60.

Survey of the steel requirements of the entire American petroleum industry and its related activities, both domestic and foreign, prepared by oil-industry men serving on the committee on petroleum-industry steel requirements, of the National Petroleum Council.

25b-49. U. S. Steel; Into Chemicals? *Business Week,* April 10, 1948, p. 30, 32.

Biggest steel company is among 10 biggest chemical concerns as result of byproducts of its coking operations. It must decide whether to process raw chemicals or continue to sell them crude.

25b-50. 1947 L. S. Iron Ore Shipments by Companies. *Skillings Mining Review,* v. 37, April 17, 1948, p. 1, 4.

25c—Nonferrous

25c-27. Mine Production of Gold. Charles White Merrill. *Western Metals,* v. 6, Feb. 1948, p. 58-61.

Data for 1947 by states.

25c-28. Consumption of Slab Zinc in the United States by Industries, Grades, and Geographic Divisions. 1940-45; Including a Summary of Consumption Since 1900. Alfred L. Ransome. *Bureau of Mines, Information Circular* No. 7450, Feb. 1948, 29 pages.

25c-29. Copper. Charles White Merrill and Helena M. Meyer. *1946 Minerals Yearbook Preprint,* Bureau of Mines, 1948, 33 pages.

U. S. and foreign statistics for a period of years.

25c-30. Tin. C. E. Nighman and J. B. Umhau. *1946 Minerals Yearbook Preprint,* Bureau of Mines, 1948, 24 pages.

U. S. and foreign statistics for several years.

25c-31. Lead. Richard H. Mote. *1946 Minerals Yearbook Preprint,* Bureau of Mines, 1948, 25 pages.

U. S. and foreign statistics. Includes comparative data for several years.

25c-32. Gold and Silver. Charles White Merrill and Helena M. Meyer. *1946 Minerals Yearbook Preprint,* Bureau of Mines, 1948, 31 pages.

U. S. and foreign statistics for several years.

25c-33. Heavy Scrap Lead Supply not Likely to Have Depressing Effect on Price of Primary Metal. Paul Herzog. *Metals,* v. 18, March 1948, p. 9-11, 13.

Presented at meeting of Lead Industries Association, New York, March 16, 1948.

25c-34. Tin During 1947 and Outlook for 1948. Erwin Vogelsang. *Metals,* v. 18, March 1948, p. 12-13.

Presented at meeting of Lead Industries Association, New York, March 16, 1948.

25c-35. Demand for Copper, Lead and Zinc Continues to Top Supply; Shortages Seen Getting More Acute. *Metals,* v. 18, March 1948, p. 16, 18.

25c-36. Six Western States Head 1947 Silver Production. *Skillings Mining Review.* v. 36, April 10, 1948, p. 6-7, 13, 15.

25d—Light Metals

25d-9. Panorama Della Produzione Della Bauxite nei Paesi Europei. (Survey of Production of Bauxite in European Countries.) F. Magri. *Alluminio,* v. 16, Nov.-Dec. 1947, p. 508-516.

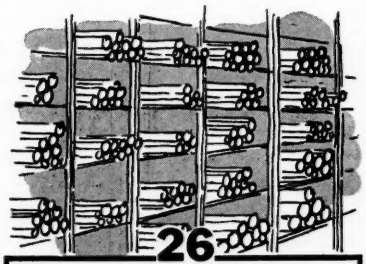
Production from 1900 to date in Italy, Germany, France, Great Britain, Ireland, Jugoslavia, Hungary, Roumania, Greece, Bulgaria, Spain, Sweden, and Russia.

25d-10. Aluminum, Bauxite, and Magnesium. Herbert L. Cullen. *Mining Congress Journal,* v. 34, Feb. 1948, p. 104-107.

Economic trends and recent statistics.

25d-11. Presenting a Review of Aluminum Markets. *Light Metal Age,* v. 7, April 1948, p. 15-20.

A summary prepared by Aluminum Company of America.



26 MISCELLANEOUS

26a—General

26a-31. Small Foundries Can Engage in Research and Development. Harry Czyzewski. *American Foundryman,* v. 13, March 1948, p. 54-56.

Ways in which research can be done without exorbitant outlays, including use of cooperative research groups, equipment manufacturer's research, and research institutes.

26a-32. The Interrelation of the Engineering and Metallurgical Industries. Arthur P. M. Fleming. *Foundry Trade Journal,* v. 84, Feb. 19, 1948, p. 169-175.

A survey of complementary developments. (Presented at meeting of Institute of British Foundrymen.)

(Turn to page 60)

Gensamer Expounds Fundamental Concept Of Alloying Effects

Reported by J. J. Preisler
Sperry Gyroscope Co.

The principal effect of alloying elements in steel is to shift the TTT-curve to longer time, avoiding high-temperature tranformation products at lower cooling rates, and thus increasing hardenability. This fundamental concept was presented by Maxwell Gensamer of the Carnegie-Illinois Steel Corp. at the New York Chapter meeting on Feb. 9. Dr. Gensamer's talk on "The Alloying Elements in Steel" was given before a large audience of A.S.M. members and friends who paid their respects to former gavel-wielders at the annual Past Chairmen's Night.

Dr. Gensamer confined his discussion to medium and low-alloy steels, thus omitting electrical and magnetic steels, corrosion resistant steels, and others, whose properties are derived from major additions of specific alloying elements.

In ferritic steel, alloying elements are found in the cementite or carbide phase, or dissolved in the ferrite. Alloys dissolved in ferrite increase hardness and strength, at some sacrifice in ductility. By the use of slides, it was shown that the increase in strength of ferrite varies parabolically with the per cent of alloying element in solution. However, the tensile strength that can be obtained by alloy solution in ferrite is quite limited.

On the other hand, the increase in strength that can be achieved by dispersing hard carbide particles in the soft matrix is considerable. It has been found that the strength varies regularly with the mean distance from one carbide particle to the next one, and that the strength is not affected by shape of the carbide particles.

The important effect of alloying elements in the heat treating steels is to control the number and distribution of the carbide particles. To control the number of carbide particles in the most effective way involves quenching to martensite and tempering to the necessary particle size. Without alloying elements, the size of piece which can be quenched to martensite is limited; alloying elements, by improving hardenability, increase the size of piece which can be quenched and hence controlled as to particle size after tempering. In heavier sections, alloying elements cause the austenite to decompose at lower temperatures, resulting in smaller carbide particles and increased strength, and in some instances improved ductility because of more favorable microstructures.

In the numerous instances involving transformation during continuous cooling, and hence involving mixed microstructures, the problem of predicting the properties from the microstructure is so difficult and complicated that there seems little hope of understanding it in detail; a more powerful and general method of attack is needed, comparable to the methods of thermodynamics or of least work in mechanics.

Symposium on Electron And Light Microscopy

A symposium emphasizing the supplementary relationship between electron and light microscopy sponsored by Armour Research Foundation of Illinois Institute of Technology and the physics department of the Institute is to be held at the Stevens Hotel Chicago, June 10, 11, and 12. The three-day session will consist of invited papers and planned discussion covering instrumentation, techniques. and applications of both electron and light microscopy. Thursday and Friday will consist of general meetings while Saturday will be devoted to panel discussions.

Further information may be had from either W. C. McCrone or C. F. Tufts at the Armour Research Foundation of Illinois Institute of Technology, 35 West 33rd Street, Chicago 16, Ill.

Puget Sound Officers Night

Reported by T. Carlson
Isaacson Iron Works

National Officers' Night of the Puget Sound Chapter A.S.M. featured National President F. B. Foley and National Secretary W. H. Eisenman. Mr. Eisenman addressed the group in his usual entertaining manner, and brought the members up to date on his farm affairs and the activities of the society in fitting style.

Mr. Foley, chief research engineer for the Midvale Co., discussed "Alloys for Elevated-Temperature Service" most authoritatively.

Ford Key Executive Dies

Russell H. McCarroll, 58, director of chemical engineering and metallurgical research for Ford Motor Co., died of a cerebral hemorrhage on March 31. A member of the Detroit Chapter A. S. M., he was honored by a place in *Metal Progress's* "Biographical Dictionary of Eminent Living Metallurgists" in the September 1947 issue.

He graduated from University of Michigan in 1914, and joined the rapidly growing Ford organization in 1915, where his experience was wide and varied and gave him many opportunities to expand the art and science of metallurgy.

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Electronic methods for the measurement of strain in metals, by H. F. Hamburg, supervisor of research test, Chance Vought Aircraft, Division of United Aircraft Corp. . . . Spectrochemical analysis of metals and alloys by direct intensity measurement methods, by J. L. Saunderson, spectroscopy laboratory, Dow Chemical Co. . . . Uses of the DuMont cyclograph for testing of metals, by R. S. Segsworth, research engineer, General Engineering Co., Ltd. . . . Supersonic methods of metal inspection, by E. O. Dixon, chief metallurgist and mechanical engineer, Ladish Co. . . . Determination of seams in steel by magnetic analysis equipment, by Charles M. Lichy, assistant metallurgist, Pittsburgh Works, Jones & Laughlin Steel Corp. . . . Electron microscope and its application to metals, by Charles S. Barrett, Institute for the Study of Metals, University of Chicago . . . Electronics in liquid steel, by Harold T. Clark, assistant director of research, Jones & Laughlin Steel Corp.

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26a-33. Industrial Uses of Selected Minerals. Guide List of Industrial Uses of Mineral Resources. *U. S. Department of Commerce, Industrial Series No. 72*, 35 pages.

A listing of 206 commercially significant minerals with their principal industrial uses

26a-34. Metallurgical Tracers and Naval Research. Julius J. Harwood. *Journal of the American Society of Naval Engineers*, v. 60, Feb. 1948, p. 49-63.

A brief description of the fundamental principles involved. A number of metallurgical projects, involving use of radioactive tracers, being worked on for the Navy at the Carnegie and Stevens Institutes of Technology.

26a-35. Metallurgical Books. Sibyl E. Warren. *Metals Review*, v. 21, March 1948, p. 25, 27.

First installment of a bibliography, classified by subject matter, of metallurgical and near-metallurgical books published during 1936-1946 inclusive. This installment covers process metallurgy. Neither selective nor annotated. (To be continued.)

26a-36. Manufacturing Advances in Wartime Germany. John I. Kent. *Scientific American*, v. 178, April 1948, p. 161-164.

Following machines and processes: cold steel extrusion; salt-bath heat treatment; high-speed trip magnet; powder metallurgy; and boring-milling machines.

26a-37. Metallurgy and Atomic Energy. (Continued.) C. Hubert Plant. *Metallurgia*, v. 37, Feb. 1948, p. 178-180; March 1948, p. 248-252.

Most advantageous elements for liberation of atomic energy are those at the two ends of the periodic table. The use of atomic energy as an aid in the development of new alloys or as an aid to present-day metallurgical processes. (To be continued.)

26a-38. The Metallurgical Laboratories of the B. W. R. A. J. G. Ball. *Welding*, v. 16, March 1948, p. 106-112.

Organization and equipment of the metallurgical laboratories of the British Welding Research Assoc. in London. Main features of the present research program.

26a-39. New Research and Development Laboratories Opened by Canadian Westinghouse Co., Ltd. *Canadian Metals & Metallurgical Industries*, v. 11, March 1948, p. 16-17.

Facilities and equipment of new chemical, physical, electrical, and metallurgical laboratories.

26a-40. Low Temperature and Some of Its Effects Upon the Behavior of Matter. S. C. Collins. *Science*, v. 107, April 2, 1948, p. 327-333.

Surveys field. 35 ref.

26b—Ferrous

26b-14. Former Wasteland Now Western Steelmaking Enterprise. G. Eldridge Stedman. *Steel*, v. 122, March 8, 1948, p. 128, 130, 132, 135, 138.

Integrated steel plant at Geneva, Utah. Additions to plate mill will afford production of light-gage flat-rolled stock for conversion to cold strip at West Coast plants.

26b-15. Considerations in the Fabrication of Stainless Steel. A. S. Tuttle. *Canadian Metals & Metallurgical Industries*, v. 11, Feb. 1948, p. 18-22, 35-36.

Fundamental principles; properties; compositions; methods for welding, forming, heat treatment, and machining; and choice of the proper alloy for the job. Table gives compositions; physical, mechanical, and electrical properties; heat treatment schedules; heat resistances; weldabilities, machinabilities; and abilities to be drawn or stamped.

26b-16. Coil Spring Research. *Wire Industry*, v. 15, Feb. 1948, p. 112, 118.

Research progress on four different problems in connection with coil springs by the Coil Spring Research Organization in Britain.

26b-17. Modern Trends in Nickel Steel and Cast Iron Gear Materials. Charles M. Schwitter. International Nickel Co., 1948, 20 pages.

Compositions, properties, test data, processing methods. 23 ref.

26b-18. The Automobile Industry That's Behind the Iron Curtain. Part III—Research and Development of Russian Motor Vehicles. D. B. Shimkin. *Automotive Industries*, v. 98, April 1, 1948, p. 30-33, 53-54.

Soviet research in motor vehicles is said to be very ineffective for various reasons. Soviet tests and experience with Lend-Lease vehicles. A common drawback was unsuitability for operation at the extremely low-temperatures common in the Soviet Union. Among the post war advances of importance is the development of a Cr-Mn-Ti steel for gears. 104 ref. (9 English, 95 Russian.)

26b-19. Weight of Steel Bar for 1000 Pieces. *American Machinist*, v. 92, April 8, 1948, p. 141.

Nomograph type chart is used to determine the weight of round-steel bar stock required for 1000 pieces of known diameter and length within a range of approximately 0.10 in. diameter by 0.20 in. long to 1½ in. diameter by 4 in. long.

26c—Nonferrous

26c-7. Standards. Edition 2. Copper & Brass Research Assoc., New York. Feb. 11, 1947, 70 pages.

Indexed and tabulated standards for mill products of copper, brass, bronze, and related alloys.

26c-8. Surface Active Agents as Applied in Nonferrous Metal Technology. J. Koernar. National Lead Co. Research Laboratories, Brooklyn, 9 pages.

Theoretical and practical considerations as applied to soft-solder fluxes, etching solutions, cleaning solutions, wetting down of dusty drosses, and other applications.

26c-9. The Story of Tantalum. Clarence W. Balke. *Chemistry & Industry*, Feb. 7, 1948, p. 83-86.

Occurrence, preparation and fabrication methods, and uses. Also discusses columbium briefly.

26c-10. Health Experiences in the Fields of Manufacture and Use of Beryllium Alloys and Beryllium Compounds. Beryllium Corporation, Reading Pa., 1948, 4 pages.

Data which indicate that little or no hazard is involved. 13 ref.

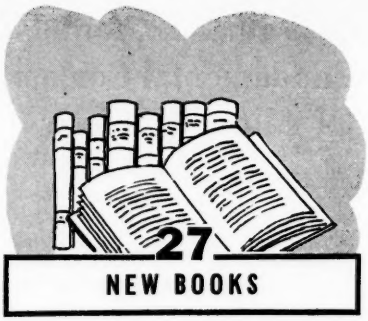
26c-11. Minerals for Chemical and Allied Industries. A Review of Sources, Uses and Specifications— Part XVIII. Sydney J. Johnstone. *Industrial Chemist and Chemical Manufacturer*, v. 24, March 1948, p. 163-168.

Platinum metals and potassium. (To be continued.)

26d—Light Metals

26d-4. Aluminium-Legeringen. (Aluminum Alloys.) A. Swagerman. *Metalen*, v. 2, Feb. 1948, p. 109-117.

World production of aluminum compared to the production of some heavy metals for the last 15 years. Production methods. Compositions, properties, casting methods, testing, and applications of cast aluminum alloys.



27a—General

27a-41. Running a Machine Shop. F. H. Colvin and F. A. Stanley. Edition 2. 521 pages. 1948. McGraw-Hill Book Co., 330 W. 42nd St., New York. $4.25.

This practical guide to practices for both large and small shops covers subjects from methods of determining what kinds of jobs the shop can best handle to a complete toolroom system. The new material in this edition deals largely with management problems.

27a-42. Chemistry of Engineering Materials. Ed. 4. Robert B. Leighou. 666 pages. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. $4.50.

As in previous editions, stress is placed on the chemical properties of engineering materials so that these materials may be more intelligently selected and used. The only requirement for the reader is a knowledge of elementary general chemistry. References are given at the end of each chapter. Subject matter covered includes water for steam generation; fuels, combustion, and lubricants; refractories; nonferrous metals and alloys; production of iron and steel; alloys of iron; technology of shaping metals and alloys; corrosion of metals and alloys; protective metallic and inorganic coatings; building stones; lime and gypsum products; portland cement and concrete; clay and clay products; abrasives; glass; organic plastics; natural and synthetic rubber; organic protective coatings; glues and adhesives; and insulating materials. (From review in *India Rubber World*, v. 118, April 1948.)

27a-43. Fundamentals of the Theory of Statistics. Elementary Statistics and Applications. Sampling Statistics and Applications. Ed. 1. James G. Smith and Acheson J. Duncan. 720 and 498 pages. 1944 and 1945. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Constitutes a set of 2 volumes. Principles of gathering and presenting statistics, frequency-distribution analysis, probability theory and the normal curves, correlation, time-series analysis, and forecasting. The 2nd volume, intended for advanced students or research workers, discusses the general theory of frequency curves and the theory of random sampling. Illustrates applications to a variety of problems.

27a-44. Manual of Structural Design. Edition 3. Jack Singleton. 336 pages. H. M. Ives & Sons, Topeka, Kansas. $6.00.

A collection of original tables, design charts and specifications useful in solution of structural design problems. 1946 simplified list of wide-flange shapes, data on welding

(Turn to page 62)

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Fully illustrated 6-page leaflet discusses application of high speed methods of electrolytic analysis of vital metallurgical products. Sargent-Slomin analyzer and its precision results are described. E. H. Sargent & Co.

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8-page, 2-color bulletin 120-23-B11 covers foundry cupola blowers of both the rotary positive and centrifugal types; includes table giving melting rate, with air volume and pressure required, for standard size cupolas. Roots-Connersville Blower Corp.

45. Dies, Heat Treatment

Design of dies and tools with consideration given heat treatment is discussed in feature article in current "Heat Treating Hints". Lindberg Engineering Co.

46. Fabrication, Light Metals

Engineering, tool and production facilities offered by sheet metal fabricator specializing in the light metals are described and illustrated in 20-page brochure. Colgate Mfg. Co.

47. Furnaces, Melting

4-page illustrated leaflet describes an improved reverberatory melting furnace. Combustion is improved, lining life increased, fuel consumption decreased. Melts all types and kinds of metals. Sklenar Furnace & Mfg. Co.

48. Hardening, Flame

Attractive 20-page booklet discusses "Flamatic" machine for selective surface hardening with precision electronic temperature control. Cincinnati Milling Machine Co.

49. Metals, Plated

20-page illustrated booklet G features use of preplated metals. Hundreds of products are shown. Physical properties, tempers are given. American Nickeloid Co.

50. Metal Sawing

16-page booklet unique engineering experience embodied in line of four basic circular sawing machines for cutting stock from ¼" to 16½", all utilizing the advantages of the triple-chip saw blade in diameters from 8" to 45", with correct automatic sharpeners to grind all blade sizes. Motch & Merryweather Machinery Co.

51. Parts, Powder Metal

4-page leaflet describes complete facilities for producing powder metal parts of all kinds, with porosity or density controlled to meet specific requirements. Michigan Powdered Metal Products Co. Inc.

52. Polariscopes

Bulletin 143-74 on photoelasticity polariscopes describes apparatus used for obtaining experimental solutions to problems of stress distribution in mechanical parts and structures. Gaertner Scientific Corp.

53. Powder Metal

4-page leaflet discusses powder metal parts, bearings, slip ring and commutator brushes, and negative temperature coefficient resistance units. Keystone Carbon Co.

54. Presses, Hydraulic

44-page booklet, well illustrated, presents the line of hydraulic production presses, with capacities from 3 to 7200 tons. A. B. Farquhar Co.

55. Stainless Steel

36-page handbook simplifies selection of the right stainless steel. Compares qualities, characteristics, uses, mechanical, physical, electrical, magnetic, heat resisting and corrosion resisting properties. Extensive technical data in form of graphs, charts and tables. Alloy Metal Wire Co. Inc.

56. Surface Measurement

4-page leaflet describes the Proficorder for giving a clear chart record of the shape, height and spacing of widely-spaced surface irregularities, including long waves and bows, non-symmetrical profiles, such as steps, plateaus, peaks and grooves. Shows fine roughness irregularities in full detail. Physicists Research Co.

57. Welding Control

General products catalog includes illustrated description of several controls for resistance welding. Raytheon Mfg. Co.

57. Welding Control

28-page welding products bulletin is complete treatise on how to keep equipment of all types operating and producing through conservation welding. Photographs, drawings, and descriptions explain the low-cost method of keeping parts by repairing, rebuilding, reclaiming and hard surfacing with welding rods and electrodes. Ingenious shortcuts are illustrated. American Manganese Steel Div., American Brake Shoe Co.

59. Welding, Resistance

40-page catalog is profusely illustrated and replete with diagrammatic and specification chart material on resistance welding tips, holders and alloys. Chart shows recommended electrode materials for spot welding similar and dissimilar metals. P. R. Mallory & Co. Inc.

60. Welding, Spot

4-page leaflet describes special multiple spot welder designed and built for toy manufacture. Operations are pictured and described in some detail. Sciaky Bros. Inc.

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and on aluminum, tables of fixed-end moments and on roof decks. Design specifications have been brought up to date.

27a-45. Oxy-Acetylene Welder's Handbook. Edition 4. T. B. Jefferson. 274 pages. 1948. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York. $2.50.

Much of the material presented in earlier editions has been rewritten and new illustrations have been introduced. The book has been written in the manner most apt to prove helpful to the student and the small shop welder. (From review in *Welding Engineer*, v. 33, April 1948.)

27a-46. Mechanics for Engineers. Edward R. Maurer, Raymond J. Roark, and George W. Washa. 425 pages. John Wiley and Sons, Inc., 440 Fourth Ave., New York. $4.00.

This text book on statics and dynamics is the third rewriting of Maurer's "Technical Mechanics". Much attention is given to noncoplanar forces in statics. Dynamics, kinematics and kinetics are treated concurrently. Methods of vector analysis are used in the discussions of curvilinear motion of a particle and of spherical and general motion of a rigid body. D'Alembert's principle receives greater emphasis. Virtual work and mechanical vibrations are added topics.

27a-47. The Fracture of Metals. M. Gensamer, E. Saibel, J. T. Ransom, and R. E. Lowrie. 84 pages. American Welding Society, 33 W. 39th St., New York, N. Y. $1.00. Previously published in *Welding Journal*, v. 26, Aug. 1947, p. 443s-484s.

This report summarizes the literature and also the results of interviews with outstanding men in the field. It represents a compilation of present knowledge of the laws and the fundamental mechanism of fracture. Part I includes the original survey of the literature and an analysis of the theories of fracture and applications of principles. Part II clarifies new developments in the theories of fracture and plastic flow. A recommended research program is outlined. (From review in *Steel Processing*, v. 34, April 1948.)

27a-48. Precision Investment Castings. Edwin Laird Cady. 356 pages. 1948. Reinhold Publishing Corp., 330 W. 42nd St., New York.

Process and its applications. Chapters on design, properties of various metals and alloys, master patterns and molds, methods of investing, and casting.

27a-49. The German Metal Finishing Industry. F. Taylor, L. W. Owen, and A. W. Wallbank. 135 pages. H. M. Stationery Office, 429 Oxford St., London, W. 1, 20s. 6d. (B.I.O.S. Final Report No. 1615, Item No. 21.)

A sequel to B.I.O.S. Report No. 429, "German Electroplating Industry" and Report No. 643, "German Anodizing Practice". Covers some of the targets already visited by previous teams with an object of amplifying and clarifying some of the information contained in these earlier reports. Its main object, however, was to obtain as broad a view as possible of industrial practice for metal-finishing processes. Lacquering and enameling practice were also examined when used in conjunction with phosphate coatings. (From review in *Electroplating*, v. 1, April 1948.)

27a-50. Analysis of Casting Defects. Edition 1. 1947. American Foundrymen's Association, 222 W. Adams St., Chicago 6, Ill.

Written to help foundrymen minimize and eliminate defective castings, this book is the result of seven years' study by a number of experienced gray-iron foundrymen. 31 basic casting defects are listed and described.

27a-51. Remple Engineering Data Book. Arthur G. Vogel. 34 pages. Rempe Co., 340 N. Sacramento Blvd., Chicago 12, Ill. $1.50.

A reference manual for design of pipe coils and fin coils. Data is included on dimensional limitations, coil development formulas, and heat-transfer factors. Profusely illustrated. Material specification data and tables of various pipe sizes and heat-transfer coefficients.

27a-52. Industrial Electric Furnaces and Appliances. Vol. II. V. Paschkis. 320 pages. 1948. Interscience Publishers, Inc., 215 Fourth Ave., New York.

Covers a field of furnaces in which diversity in design is much more pronounced than in the field covered by the first volume. Resistance furnaces and appliances; induction and high-frequency capacitance heating; and selection of furnaces. An attempt is made to introduce a fairly rigid classification of furnaces and appliances in order to simplify the subject for the student. Information on furnace materials.

27a-53. Metal Spraying and Sprayed Metal. Edition 3. W. E. Ballard. Charles Griffin and Co., Ltd., 42 Drury Lane, London, W.C.2. 32s net.

Previous editions were written by authors who had a purely scientific interest in metal spraying, whereas the present author has been connected with the commercial development of the process for 24 years. Chapters which cover practical features are written in nontechnical language. Some notes are included on use of compressed gas and subsidiary apparatus. The historical section has been considerably shortened. Essential features of the molten-metal, powder, and wire-spraying processes, the latter being dealt with especially thoroughly, as the author has been intimately connected with the process for a long time. Preparation of surfaces for spraying, installation of plant and subsidiary apparatus, special processes such as aluminizing, the nature of sprayed metal, and properties of sprayed surfaces as compared with those protected by other methods; and includes such factors as density, porosity, adhesion of deposits, magnetic and electrical properties, effect of carburizing on sprayed-steel coatings, dopes, heat treatment, corrosion. Well illustrated. (From review in *Sheet Metal Industries*, v. 25, March 1948.)

27a-54. Manual of A.S.T.M. Standards on Refractory Materials. 252 pages. Feb. 1948. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

27a-55. Proceedings of the 34th Annual Convention. American Electroplaters' Society. 308 pages. 1948. The Society, Box 168, Jenkintown, Pa.

Meeting of June 1947 at Detroit. 22 papers and accompanying discussion, as well as the usual business reports. Some of the papers were previously abstracted from other sources. The rest are being abstracted separately at this time.

27a-56. Practical Drilling Tests. D. F. Galloway and L. S. Morton. 232 pages. Production Engineering Research Assoc., Staveley Lodge, Melton Mowbray, England.

Based on metal-drilling research carried out by the I.P.E. Research Department, prior to the formation of the Production Engineering Assoc. of Great Britain. Special problems presented by the modern twist drill from all aspects.

27a-57. Friction and Wear of Piston Rings and Cylinders. Reemt Poppinga. 1948. American Society of Lubrication Engineers, 343 S. Dearborn St., Chicago 4, Ill. $3.00 for members; $3.50 for nonmembers. Translated from the German.

This is a wellknown German book. Specific information given is designed to cover the problem of wear in all of its ramifications. 636 ref.

27a-58. Introductory Physical Metallurgy. Clyde W. Mason. 134 pages. 1947. American Society for Metals, Cleveland. $3.00.

A series of lectures on introductory physical metallurgy presented to members of the A.S.M. during the 29th National Metal Congress and Exposition, Chicago, Oct. 18 to 24, 1947. Includes nature and formation of metal crystals; alloys as solid solutions; working and annealing of metals; unmixing of solid and liquid solutions; solid solution in brasses and bronzes, iron, and steel; heat treatment of steels and cast irons; and corrosion.

27b—Ferrous

27b-17. Nickel Alloy Steels; Second Edition. 1947. 700 pages. Prepared by the Development and Research Division, The International Nickel Co., Inc., New York City. An assemblage of 38 pamphlets in ring binder.

The first edition of this work, issued in 1934, has been completely revised and expanded some 40% in size, and an even greater number of subjects treated. The scope includes the plain nickel constructional steels, but also the Ni-Cr, Ni-Mo and the Ni-Cr-Mo steels, the Ni-Cr stainless steels and the high nickel-iron alloys. Especially noteworthy additions contain graphs showing the properties of these most useful alloys in various conditions, the section on carburizing (wherein Floyd Harris' exposition of the mechanism and expected results, as printed in *Metal Progress*, is leaned heavily upon), and a masterly condensation of information on the stainless steels. Outside experts have written some of the sections—for example Earle C. Smith, chief metallurgist of Republic Steel Corp., writes on "The Making and Shaping of Alloy Constructional Steels", and Peter Payson, assistant director of research of Crucible Steel Co. of America, on "The Annealing of Nickel Alloy Steels". The book also contains a collection of isothermal transformation diagrams (T.T.T. diagrams) gathered from various sources, and a very interesting set of cooling curves printed on celluloid, showing varying cooling rates from fast to slow, which can be superposed on the T.T.T. diagrams and an estimate made as to the steel's final structure and hardness after a given cooling. (In this reviewer's opinion, the appraisal of conditions during *continuous* cooling, from data acquired during *stationary* temperature dwells, involves such a large extrapolation and so many assumptions that it gives reasonably accurate information only for the extreme cases—quenching or annealing.) E.E.T.

27b-18. Conoscere l'Acciaio. (Know Your Steel.) Vol. I. Bartoli F. Masi. 92 pages. 1945. Poligono Societa Editrice, Via Cesare Battisti I, Milan, Italy.

A simple historical study of steel production covering methods, mate-

(Turn to page 64)

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

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WELDING METALLURGIST: Experienced metallurgist with welding background wanted for work on both fundamental and applied research problems. Should be able to initiate and carry out over-all research program. Metals Research Dept., Armour Research Foundation, Chicago 16, Ill.

POSITIONS WANTED

ENGINEER: M.S. in mechanical engineering. Metallurgical background. 1½ years' industrial metallurgy laboratory, 9 years teaching physical metallurgy courses. Able to apply sound metallurgical principles to the design and manufacture of metals parts. Desires chance to advance to responsible position in management. Will also consider teaching. Registered professional engineer. Age 33, married. Minimum salary $4800. Box 5-60.

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REPRESENTATIVE: For American steel and nonferrous industries in Germany. Former technical director of German high-grade steel casting shop is establishing himself as an engineering consultant and representative in western Germany. Considerable experience in steel and nonferrous metal manufacturing and consumer industries. Box 5-70.

MATERIALS ENGINEER: Ten years' experience in metallurgical and materials engineering, including development, design, and production. Has served as head of engineering laboratories and of materials and process engineering department with large aircraft manufacturer. Also research administrator with Government. Age 32, married and two children. Available for position in research, development, engineering, production, quality control, or sales. Box 5-75.

METALLURGICAL ENGINEER, BUSINESS MANAGEMENT: Age 30. Experienced in inspection of light and heavy machinery, statistical quality control, metallurgical process control, nonferrous powder metallurgy. Good supervisor and contact man. Prefers supervisory position in production, inspection or laboratory where experience can be utilized to good advantage. Present position—chief inspector. Box 5-80.

ALUMINUM FOUNDRY ENGINEER OR EXECUTIVE: Graduate metallurgist, 14 years' experience in sand, permanent mold, and precision casting of aluminum. Experience includes sand and precision casting of other nonferrous alloys. Record includes technical, metallurgical, supervisory, and managerial experience. Would like position with progressive company. Box 5-85.

METALLURGICAL ENGINEER: B.S., graduating from University of Illinois in June 1948, desires employment in the Chicago area. Single man with some experience in commercial heat treating. Available for personal interview. Box 5-90.

METALLURGIST: Age 25, married. Graduate of Temple University. Five to six years' experience in heat treatment, steel mill, tubing and laboratory work in steel mill and industrial plant. Knowledge of castings. Desires position in sales, customer contact or responsible position in metallurgy with manufacturer, preferably in Philadelphia area. Box 5-95.

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METALLURGIST: B.S. in metallurgical engineering. Age 23. One year of recent experience in metallography and materials control, ferrous and nonferrous. Laboratory research position desired. Eastern location preferred. Available in one month. Box 5-110.

METALLURGICAL ENGINEER: Age 28. 4½ years varied experience. Plant metallurgy and research. Interested in joining metallurgical staff of organization engaged in diversified manufacturing. East or Midwest preferred. Box 5-115.

METALLURGICAL DEVELOPMENT ENGINEER: Large experience in development of physical metallurgical processes and material for manufacturing applications. Special experience in resistance welding, atmosphere heat treating, powder metallurgy, refractory metals, wire technology. B.S. in physical metallurgy from M.I.T. Age 27, married, veteran. Desires position with medium-sized metallurgical firm. Box 5-120.

PHYSICAL METALLURGIST: Age 28, married. Receiving M.S. in physical metallurgy at Case Institute in June. Desires position in industrial research or development. Particularly interested in nonferrous field. Two years' industrial experience. Will consider East or Midwest location, with preference in Cleveland area. Box 5-125.

METALLURGIST: B.S. in metallurgical engineering, with 12 years comprehensive industrial experience, wants to fill your opening and take on further responsibilities. Knows working, testing, inspection, heat treating of most carbon and alloy grades of steel. Has known only positions involving highest product quality requirements. You can confidentially investigate this legitimate inquiry. Box 5-130.

METALLURGIST: Undergraduate, Age 29. Seven years in steel plant. Four years' experience in metallurgical quality control, 3 years' experience in laboratory investigation and research. Technical reports. Desires position in development, control, production or sales in ferrous field. Box 5-135.

TEACHER: For Fall of 1948. Honor graduate of major university. B.S. in metallurgical engineering. Tau Beta Pi. Four years' industrial experience in laboratory, forging and foundry. Previous teaching experience. Box 5-140.

WELDING ENGINEER: Age 35. 14 years' experience as welder, welding engineer, welding instructor, service engineer, field engineer. Experience covers all types of manual welding; particularly adept at automatic submerged melt and inert gas welding, automatic control circuits. Studied electricity, engineering design, welding metallurgy. Details on request. Will consider any location. Box 5-145.

METALLURGICAL ENGINEER AND SALESMAN: Desires responsible position in production or sales. Eleven years' plant supervisory experience in press forging and drop forging including heat treatment, specifications, machining and inspection. Three years' experience as alloy, tool steel and forging technical salesman. Age 36, married. Box 5-150.

CONTACT METALLURGIST: B.S. in metallurgical engineering at the University of Pittsburgh, June 1947. Age 25, single. One year's experience in ferrous and nonferrous metallurgical problems with a large electrical concern. Desires permanent position in contact metallurgy or work of similar nature in the Philadelphia area. Ambitious, and willing to study and train. Box 5-155.

METALLURGICAL MATERIALS ENGINEER: B.S. in metallurgy. Age 28. Six years' experience with large chemical company in the evaluation, selection and specification of metallic and non-metallic materials for chemical process equipment. Desires responsible position with reputable firm in the East or Midwest. Box 5-160.

METALLURGIST: M.S.E. degree 1932 from recognized university. Seven years' experience with automobile plant—metallographic, process development, trouble shooting. Six years' experience in steel mill with claims and trouble on sheet steel. Taught metallurgy in night school for five years. Prefers Ohio-Michigan area. Box 5-165.

(Continued on page 64)

rials, alloying elements for special steels, crystal structure of cast iron and steel, and practical applications. Dictionary of technical terms used in the steel industry.

27b-19. Das Härteverhalten der Edelstähle. (The Hardness Behavior of Refined Steels.) Jos. Kubasta. 187 pages. 1940. Verlag von Wilhelm Knapp, Halle (Saale), Germany.

Hardness properties and qualities of steel and the possibilities of fracture in hardened steels. Migration phenomena, structural changes, stresses and fractures due to hardening, gas content and melting processes for various types of special steels. Both tool and structural steels are evaluated.

27b-20. Metodi di Analisi Chimica Siderurgica. (Methods of Analysis of Steelworks Materials.) G. Gavioli. 379 pages. Ulrico Hoepli, Milan, Italy. 1200 lire.

All of the various raw materials entering a steelworks, and all of its products and byproducts—both the older and the more recently developed methods such as gravimetric, volumetric, photometric, potentiometric, and other types. Gas-volumetric method for carbon and the vacuum-fusion method for gases. Reagent preparation, standardization, and recovery. The methods are in line with modern practice and are clearly described along with explanations of their theoretical bases.

27b-21. Yearbook of the American Iron and Steel Institute. 718 pages. 1947. The Institute, 350 Fifth Avenue, New York 1, N. Y.

Proceedings of New York general meeting, May 21-22, 1947. Most of the individual technical papers were previously abstracted from preprints or journal sources. The remainder are being abstracted separately at this time.

27b-22. Grundlagen der Eisengewinnung. (Fundamentals of the Production of Iron.) Robert Durrer. 210 pages. 1947. Veerlag Francke, A. G., Bern, Switzerland. 20 Swiss francs.

27b-23. Tool Steel Simplified. Revised edition. Frank R. Palmer and George V. Luerssen. 564 pages. 1948. Carpenter Steel Co., Reading, Pa. $2.00 in U. S.; $2.50 elsewhere.

Subtitled "A handbook of modern practice for the man who makes tools". Presents simplified methods for selecting and heat treating toolsteel, written in clear nontechnical language. Chapters dealing with heat treating equipment and methods, furnace atmospheres, and quenching and tempering have been revised and enlarged. Three new chapters have been added. Chapter 9, longest in the book, is a display of specific recommendations for using the publisher's steels for certain tools. About 200 types of tools and dies are listed. Chapter 13 describes the heat treatment and properties of four steels: 18-4-1 and 6-6-2 high speed steels and 9% tungsten and 5% chromium hot work steels. Chapter 19 discusses the time required to heat toolsteel. The specific data in this chapter are especially valuable additions to the book and should be of direct application in heat treating. T.L.

27b-24. A.S.T.M. Specifications for Steel Piping Materials. 308 pages. March 1948. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Specifications for pipes, tubes, castings, forgings, and bolting.

27b-25. Report on German Blast Furnace Practice and Plant. 57 pages. 1946. British Iron and Steel Federation and British Iron and Steel Research Assoc., London.

Prepared under auspices of a British Intelligence Subcommittee. Development of German blast-furnace practice and design during the war. Among the changes in processes and equipment, the progress in installation of plants for ore crushing and sintering is particularly noted. Changes in furnace design are discussed as well as progress in the development of blower equipment; gas-cleaning practice; and vortex dust catchers. (From review in *Mining and Metallurgy*, v. 29, April 1948.)

27b-26. Master Boiler Makers' Assoc., Official Proceedings of the 1947 Annual Meeting. 325 pages. 1947. The Association, 29 Parkwood St., Albany, N. Y.

Several papers and accompanying discussion presented at Chicago, Sept. 15-18, 1947, as well as miscellaneous committee reports. Deals largely with locomotive boilers, in their metallurgical, design, operation, and maintenance aspects. (Some of the individual papers are being abstracted separately.)

27b-27. 1947 Addenda to A.S.M.E. Boiler Construction Code Material Specifications. 120 pages. 1948. American Society for Mechanical Engineers, 277 Broadway, New York 7, N. Y.

27c—Nonferrous

27c-7. Die Edelmetalle und Ihre Legierungen. (The Noble Metals and Their Alloys.) Ernst Raub. 323 pages. 1940. Julius Springer, Berlin, Germany.

Physical and chemical properties and results of cold working of silver, gold, and platinum metals and their alloys. The absorption of gases by noble metals, primarily oxygen, hydrogen, and nitrogen. In the case of the platinum metals, heavy hydrogen is also discussed.

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EMPLOYMENT

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FOUNDRY OPERATIONS: Leading to foundry management. Recent graduate with B.S. in metallurgical engineering. Age 27, married, one child. 1½ years' experience in research and development testing; 3½ years in Army—road and building construction, administrative, supervision, equipment scheduling and maintenance. Wants foundry operating experience with progressive organization. Anywhere in U.S. Box 5-175.

METALLURGICAL SALES ENGINEER: Age 22, single, veteran. Graduating with B.S. in metallurgical engineering, University of Illinois, June 1948. Desires position with future as sales engineer. Location unimportant. Available July 10, 1948. Box 5-180.

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SALES ENGINEERING: Metallurgical engineer with nine years' industrial experience in steel fabrication. Now doing sales work. Would like sales engineering position with company manufacturing metal products. Located in southern Michigan. Age 32, married, two children. Willing to move. Box 5-195.

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RESEARCH METALLURGIST: Age 33, B.S. in metallurgy. Wide experience in ferrous and nonferrous metals, foundry control, heat treating, welding, brazing, plating, metal finishing, corrosion, purchase specifications, physical testing, cost control, fabricating problems, research on cavitation, steam erosion antigalling, and high temperature properties of alloys. Also steel mill experience. Responsible position with future wanted. Location immaterial—U. S. or foreign. Box 5-210.

METALLURGICAL ENGINEER: Ph. D., formerly chief metallurgical engineer and director of research and development, desires supervisory position of responsibility. Twenty years' experience in research and production problems, ferrous and nonferrous. Box 5-215.

HEAT TREAT SUPERINTENDENT — ASSISTANT METALLURGIST: Graduate metallurgical engineer with wide practical experience in production heat treating; 12 years of practical experience in ferrous heat treating field with constructional steels, tool and die steels, trouble shooting, specifications, metallography. Familiar with most types of heat treating equipment such as electric, gas, salt, flame and induction heating. Age 41. Box 5-220.

METALLURGICAL ENGINEER: Age 31; 1939 graduate. Experienced in iron and steel foundry, forging, all methods of ferrous heat treatment, chromium plating and laboratory work. Some sales experience. Now in charge of research and development department. Interested in supervisory position or as executive's technical assistant. Box 5-225.

METALLURGICAL ENGINEER: B.S. Met. Eng. Purdue University. Age 30, married. Seven years' experience in process engineering, metallurgical quality control or heat treat and foundry products. Experienced in electric furnace melting of cast iron, flame and induction hardening, heat treat layout, design and installation. Midwest preferred. Box 5-230.

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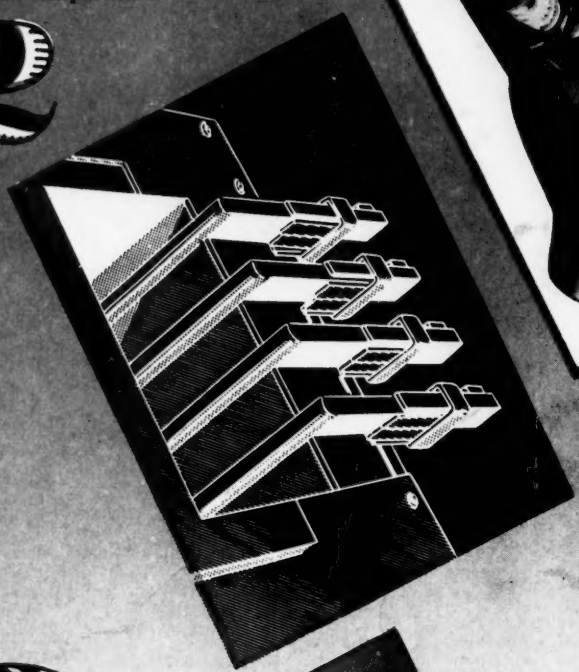

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